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MR. FERBER's

TRAVELS

THROUGH

ITALY.

TRAVELS
THROUGH
ITALY,
In the Years 1771 and 1772.

DESCRIBED IN [Ignaz von]

A SERIES of LETTERS to BARON BORN,

ON THE

NATURAL HISTORY,

PARTICULARLY

The MOUNTAINS and VOLCANOS of that COUNTRY,

Johann Jakob Ferber

By JOHN JAMES FERBER,

Professor of NATURAL HISTORY at MIETAW in CURLAND, and Member of several LITERARY SOCIETIES.

TRANSLATED FROM THE GERMAN;

With EXPLANATORY NOTES, and a PREFACE on the present State and future Improvement of MINERALOGY.

Rudolf Erich Raspe

By R. E. R A S P E.

In nova fert animus mutatas dicere formas.

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PREFACE.

BY the classical education received in our infancy we are imperceptibly acquainted with Italy; and, being favoured by nature, or inspired by fashion, with a taste for Arts and Sciences, it is with pleasure and improvement that we afterwards travel over the Alps, and peruse the descriptions of this beautiful country. Happy in its climate, and distinguished by the ingenuity of its inhabitants, it has twice, under the Romans and Popes, with an almost universal sway, presided over the better part of the world. At two different periods it has nursed and improved the Arts and Sciences. In former times, it handed them down by the Roman Colonies to distant barbarous nations. Since the last Gothic ages, they revived again in the genius of Petrarch, Dante, Boccace,

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Raphael, and Leo X. who ſpread their glory, light, and influence, over the whole inhabited world; never, it is hoped, to be loſt again. By a juſt return, every Art and Science, and every civilized nation, have been emulous to embelliſh Italy, and to give teſtimony to its highly deſerved celebrity.

Per varios caſus & multa diſcrimina rerum
Tendimus in Latium.

In conſequence, this remarkable part of Europe, having been ſo much viſited and examined, and ſo amply deſcribed by able writers, now affords but few topics for the modern traveller to enlarge upon. There have, however, of late appeared ſome deſcriptions, which prove, that ingenious men may yet conſider Italy in a new point of view. It would be ungrateful not to acknowledge the obligations we are under, to the publications of La Condamine, Richard, La Lande, Groſley, Volckmann, Tozzetti, Fortis, Riedeſel, Brydone, and Burney; and it would be unfair not to rank

Mr. Ferber among thoſe who found in Italy objects,

Unde prius nulli velarunt tempora Muſae.

This gentleman was born at Carlſcrona in Sweden, and had his education at Upſal, that famous ſchool of Natural Hiſtory, where *Linnæus*, *Cronſtedt*, and *Wallerius*, have ſo ſucceſsfully ſyſtematized the different kingdoms of Nature; and where, of late, ſo many eminent Naturaliſts have been inſpired with their genius. *Ferber* caught a true ſpark of it. Not idly devoting himſelf with many ſecond-rate diſciples of *Linnæus* to the collection and claſſification of plants, he betook himſelf rather to the abſtruſer ſubterraneous kingdom of Nature; which, from its being ſurrounded with darkneſs, and attended with difficulties, has hitherto been too much neglected. Nor did he cramp his underſtanding with the barren nomenclatures of foſſils. He thought of ſatisfying himſelf; and of improving ſcience, for the ſcholar and the miner. In this view he examined

the mines and ſmelting-places in Sweden, and travelled, from the year 1768 to 1773, through Germany, Holland, Switzerland, France, England, Bohemia, Hungary, and Italy, in order to enlarge and rectify his ideas, and to gather that various inſtruction, from the learned and the unlearned, from Philoſophers, Chemiſts, Miners, and Smelters, which the improved culture of thoſe countries offers to the obſerver.

He made at ſeveral times a long ſtay in Germany, the beſt as well as the moſt ancient ſchool in Europe for miners and metallurgiſts. The old rich mines of the Hartz-foreſt, with its furnaces, ſeemed to him remarkably inſtructive in their nature, and in the wiſe œconomy by which they are conducted and regulated; and, indeed, there are but few mines, which, on that account, will bear a compariſon with them.

The very uſeful Academy for Miners at Freiberg in Saxony ſatisfied and inſtructed him. The arts of mining, ſurveying, working, and ſmelting, are taught there, by able maſters,

maſters, upon ſcientific principles; and in that place he ſeems to have conceived a thought of enlarging upon Baron *Pabſt v. Ohain's* idea of a phyſical or ſubterraneous geography, and of collecting on his travels as many facts as might generaliſe them, and reduce the art of diſcovering and purſuing metallic veins to better principles. Hitherto it was entirely left, either to chance, or the ſuperſtitious and ignorant practices of common workmen; perhaps to the perſonal ſkill and unſyſtematic empirical experience of illiterate miners, which of courſe is confined to ſingle mountains, and ſcarce ever outlives the man. I need not dwell on the advantages of this happy idea; ſince, from the preſent publication, and ſome others which I ſhall ſpeak of afterwards, it is obvious how inſtructive it muſt prove for the art of Mining; which, after the Nautical art, ſeems to be the moſt complicate, expenſive, and hazardous, of all.

I was acquainted with him in the year 1768, when from Saxony and the Hartzforeſt he went to Holland, France, and England.

We examined together the Habichwald near Caſſel; and as, till that moment, he had ſeen no volcanic mountain, reputed to be ſuch, he was not altogether ſatisfied with my Syſtem of the Earth, which in 1763 had been publiſhed at Amſterdam. I was led to ſuſpect, what farther obſervations have convinced me of, that this huge and uncouth heap of mountains is a monument of ancient volcanic eruptions. He has certainly in theſe Letters on Italy made me large and liberal amends, ſince he has confirmed me in my own ideas.

He was taken great notice of in England by Dr. Franklin; and every where elſe, by men of liberal minds, who conſider not ſcience as a job, nor the active friends of knowledge as encroaching intruders upon their literary reputation. Mr. Whitehurſt at Derby, with hoſpitable politeneſs and an extenſive ſolid knowledge of his country, enabled him to examine the mountains and mines of that county, and to draw up a memoir for the preſs, which hitherto has not appeared.

In

In 1770 he returned to Sweden, and was received Aſſeſſor in the Royal Department of Mines; but ſoon after ſet out again for Germany on the ſame errand as before, and which afterwards led him to Italy.

Baron Inigo v. Born, Counſellor of the Royal and Imperial Mines in Bohemia, then living at Prague, had been acquainted with him in his firſt journey to Germany, and ſeized the opportunity of this ſecond excurſion with that generous warmth which has made him one of the moſt learned and moſt liberal promoters of Mineralogy. Having formerly communicated to his friend very inſtructive and entertaining accounts of his own mineralogical travels to the Hungarian and Tranſylvanian mines, he now prevailed on Mr. *Ferber* to make him a ſuitable return for them by accounts from Italy, whither he went in the latter end of 1771, after having made repeated and very intereſting examinations of the Bohemian mines.

This occaſional acquaintance of our author with Baron Born proved a great advan-

tage to Oryctology and Mineralogy; since we are indebted to it for some of the most valuable and scientific accounts hitherto written in any language. Baron Born published Mr. *Ferber's* Letters on Italy at *Prague*, 1773. Mr. *Ferber* published not only his own observations on the quicksilver-mines at Idria and on the Bohemian mines, but also the Baron's Travels to Hungary and Transylvania.

They have been received abroad with just applause; and, as it is presumed that they will meet with a similar reception in England, I have undertaken to lay them before the public, ever indulgent to the improvement of useful science. As the latter are shortly to appear, I shall here give some remarks merely on the present publication.

It is obvious, that, hitherto, no traveller has examined Italy in a general mineralogical view; and that the object of these Letters, on this account, is entirely new.

Interesting in itself, for the improvement of *Physical Geography*, and the Natural History of the Earth, it is the more so, as Italy

Italy offers many inſtructive phænomena to that purpoſe, and as the writer of theſe Letters was eminently qualified to treat of them with propriety. I ſhall not enlarge upon the vicinity of the Alps, the nature of the Apennine mountains, the many marble quarries, the great variety of foreign marbles employed by the Ancients, the alum-works at Tolfa and in the Solfatara, nor the increaſe of the ſea, which Mr. *Ferber* has taken notice of. The volcanos of this country, however, and eſpecially Veſuvius, claim particular attention.

Being ſituated in the neighbourhood of a large and populous city, this mountain had ſtruck the fancy, and engaged the curioſity, of philoſophers and travellers ever ſince the time of Pliny. However, the many deſcriptions of theſe great laboratories of Nature, which hitherto have been given to the public, are far from being ſatisfactory to Naturaliſts. Entirely taken up with hiſtorical accounts of their various eruptions, and of the horrors and devaſtations which have attended them, they indulged themſelves either

in

in ſentimental and poetical flights, or in marvellous tales of wonders performed, or rather not performed, by the noſtrums of St. Januarius, and the ceremonies of crafty prieſts. They noticed only the apparent devaſtations; and did not ſo much as imagine that the volcanic and Veſuvian horrors are concomitant majeſtic effects of the moſt active power of Nature, creating new foſſils and land by the greateſt of all chemical operations. But very few of them, and thoſe only of late, adviſed the applying theſe phaenomena, and the new-raiſed volcanic iſlands, to ſome general hypotheſis of the earth: although the Greeks, about two thouſand years ago, had ſet the faireſt example, in tracing Nature's ſyſtem by ſimilar facts. I do not allude to Father *Kircher's Subterraneous World*, in which that credulous man dreamed of a central and ſubterraneous fire; appearing no where except in his own chimerical ſections of the earth. I mean to ſpeak of the better ſyſtems of *Ray* [1], *Hooke* [2],

[1] Phyſico-Theological Diſcourſes.

[2] Treatiſe on Earthquakes, in his Poſthumous Works.

and

and *Ant. Lazaro Moro*[2]; which, in a hypothetical manner, by earthquakes, volcanos, and the action of the sea, explain, or might explain, phænomena in the surface of the earth, that hitherto had been so many stumbling-stones in other orological systems. Established upon facts, and evidenced by experience and history, these are undoubtedly in a higher scale than those of Whiston, Burnet, Woodward, and Maillet, in which, facts are supposed, and powers and errors ascribed to Nature, with which Nature appears to be unacquainted. Indeed, they are deficient in many points, and very far from having received from the hands of their authors that latitude and evidence they are capable of, as well in respect of historical truth, as of the nature and situation of fossils and mineral bodies. This, I am persuaded, stands clearly proved in my *System of the Earth*; which, for the honour of *Hooke*, and the improvement of science, was published at Amsterdam in 1763. It will farther evidently appear, from an improved edition

[2] Sopra i crostacei. Ven. 1740.

which

which I am preparing, and from what I submit here to the judgement of the reader.

That a variety of parallel and horizontal ſtrata are produced, by various cauſes, at the bottom of the ſea; that earthquakes have broken, diſordered, and raiſed large parts of them above its level; that volcanos work both under and above the ſea; and, that many foſſils are daily produced and accumulated by them into hills, high-towering over the former plains till rain and water level them again to the ground; theſe are undeniable facts, and, when properly attended to, with a due reſpect to ſome other phænomena, not only ſupport the orological hypotheſis now under conſideration, but moſt certainly give ſtrongly marked out-lines of Nature's own ſyſtem.

This ſyſtem we cannot be thoroughly acquainted with, if theſe out-lines are not filled up with variety of obſervations; they alone can give it life, and make it a true picture of the ſubterranean kingdom. Left where philoſophers have left it hitherto, it is but a faint conjectural ſketch; thus finiſhed, it will get the exactneſs of a

picture,

picture, drawn and coloured after Nature; and prove of nearly the same advantage to miners and philosophers, as well-delineated anatomical tables are of to surgeons and physicians.

I shall point out where this system was deficient, and by that means state where it remains so still.

The problem to be resolved was, in general, laid down upon too narrow principles. It was only to explain the origin of the inequalities, and of the sea-shells contained in their various parallel strata. This, indeed, is but part of the question. The *higher metallic and simple mountains*; their fissures and veins; their rocks, which never contain any adventitious organic body; their different relative situation, in respect to themselves, and to the many marine or other beds which are incumbent on them; have not been properly attended to: till very lately, we were entirely destitute of scientific and intelligible descriptions of mountains and mines, and the respective natural situation of their beds and rocks. This deficiency has been, of late, perceived and sup-

plied by ſome ingenious writers, of different nations, as will appear from the books already mentioned. The proſpect has widened, and we cannot poſſibly, henceforth, aſcribe the origin of the many rock and ſtone beds to a ſingle cauſe; whether our favourite ſyſtem be an immediate creation, or a general flood, or a general and ſucceſſive conflagration; nor are we to liſten to philoſophers, who boldly could tell us, ſome years ago, that porphyry is a red maſs, filled with petrified points of echinites; that columnar baſalt-maſſes are tubular corals; that angels and devils have been the ſubaltern architects of the mountains, and many other ſuch abſurdities,

Quæ ipſe miſerrima vidi.

The hitherto-neglected native place of the foſſils, to uſe the phraſe of Shakeſpeare, gives the *lie direct* to ſuch magiſterial nonſenſe, and tells aloud to every one, who is willing and able to hear, that Nature,

ture, in different times, and under different circumſtances, by the ſolvents of water and fire, uniformly produces, and has produced, that variety of foſſils, which caps the ſurface of the earth and fills our mineralogies. The determination of theſe various circumſtances, under which Nature produced and depoſited them, is, in reſpect to the foſſils, what the Linnæan Sexual Syſtem is to the plants; and ſhews—not what every foſſil is good for, or compoſed of—but a probable rule, by which to find and to purſue them under ground, and by which we may judge of their origin and antiquity; advantages, which can never be expected from our mineralogical ſyſtems, eſtabliſhed merely upon form, colour, and chemical aſſays; and which will, perhaps, ſome day or other, make theſe enquiries more acceptable and faſhionable. Much has been done that way, but much is ſtill left for poſterity; for which I refer the reader to Baron Born's and Ferber's accounts of the Hungarian and Bohemian mines, to my Preface added to them, and to the vaſt book of Nature, which lies before us.

2. The

2. The earthquakes and volcanos, being the chief visible and powerful causes of the inequalities and shattered condition of the surface of the earth, should long ago have engaged the philosophers to enquire into their nature and effects. Hypothetical theories we have in abundance; nay, we may at leisure hours in our closets very easily invent new ones, without improving science. But have we facts enough, well examined and well described? Have we closely attended to their various effects and circumstances? Did we make fair allowances for them, when we attempted to apply them to our orological systems? Had we from just observations abstracted infallible characters, by which we were enabled to discover their former destructions and creations, in those parts where history left us in darkness? Surely not!

Mr. *La Condamine* fairly acknowledges, that he and his fellow academicians were unacquainted with the volcanic productions, when they were sent to Peru, and frequently encamped for weeks and months on Pichincha,

chincha, Cotopaxi, and Chimboraſo; which are, perhaps, the moſt remarkable and inſtructive volcanos in the whole world.

Ant. Lazaro Moro ventured in 1740 to aſcribe all the ſtratified ſecondary mountains to volcanic eruptions; but he did not prove his aſſertion; and thus convinced nobody; nor ever will, in reſpect of thoſe beds, which viſibly are produced and depoſited by the ſea.

Count *Buffon*[1] in 1749 preſumed to ſay of all the volcanic mountains, and the new-raiſed iſlands, that "they are without "parallel beds, and that their materials and "ſubſtances are deſtitute of any regular "poſition, preſenting only the diſorder of "irregular eruptions." But what volcano, or what new-raiſed iſland, had he or other Naturaliſts examined? None.

Mr. *La Condamine*, after having ſeen Italy in 1755, ſeems to have been the firſt who obſerved, and told the public, that all the environs of Naples are volcanic; and that

[1] Hiſt. Naturelle, Edit. de Paris,

the volcanic grounds reach from thence to the very gates of Rome, and its neighbourhood, at Frascati, Grotta Ferrata, Castel-Gandolfo, Albano, Tivoli, Caprarola, Viterbo, and Loretto; these have never been noticed by historians as being at all subject to volcanic eruptions[1]. In this particular he may, perhaps, have been improved by the learned in Italy, such as *P. la Torre*[2], *Giov. Targioni Tozzetti*[3], and *Giov. Arduini*, who, about that time, published their mineralogical observations on several parts of Italy: but he was certainly the first, who, "on this side of the Alps, in Dauphiné, "Provence, and several other places, found "marks of ancient volcanos; so evident, "that his only astonishment was, that these "his conjectures should appear new, and "be thought whimsical, in a country, where, "according to his opinion, in order to form "the like conjectures, it is sufficient merely "to open one's eyes[4]."

[1] La Condamine's Tour to Italy, 1763, p. 125.

[2] Storia del Vesuvio, 1756.

[3] Viaggi di Toscana. Firenze, 1751—54. 6 vol. 8vo.

[4] La Condamine's Tour, p. 134, 135.

About

About the same time, and during Mr. La Condamine's absence in Italy (1755 or 1756), Mr. *Guettard* presented to the Royal Academy at Paris [1], a Memoir on the perfect resemblance between the Vesuvian volcanic productions, and those which he had found in Auvergne and on the Mont d'Or. Similar discoveries have since been made in many other parts of the world; in which, except these unnoticed monuments, no historical records were left, as memorials of former volcanic conflagrations.

Father *La Torre's* History of Vesuvius, and some modern descriptions of Ætna and Vesuvius, though justly considered as classical performances, and written with much historical learning, candour, elegance, and ingenuity, did not enlarge the views of philosophers, nor spread any remarkable new light on the subject. They were highly deficient in a mineralogical respect; nor had their authors ever troubled themselves about the scientific and intelligible denominations of the volcanic productions, or their various

[1] Mem. de l'Academie Royale de Paris, 1756.

ſtate, nature, ſituation, ground, principles, and connection with other foſſils. Of courſe they left us in the dark on all theſe ſubjects; told us many a pretty tale of marcaſite, bitumen, and precious ſtones; and were fair game for the ſubtle lava-dealers at Naples, who, like their kindred Italian antiquity-ſellers, cannot be ſuppoſed to be remarkably conſcientious. I have ſeen dear-bought pretended Veſuvian precious ſtones, which, upon nearer examination, were found to be artificial glaſſes; and ſome tables, inlaid with pretended Veſuvian and Sicilian lavas, which, for the greater part, were extremely apocryphal, or conſiſted of marbles.

Mr. *Deſmareſt*, an eminent mineralogiſt, who was employed for ſome time to examine the natural productions of France, obſerved that ſome maſſes of priſmatical baſaltes in Auvergne are immediately connected with the lavas and other volcanic foſſils of that country; and, being in their ſubſtance and colour ſo nearly related to them, he ventured in 1768 the hypotheſis, "that this ſort of "ſtone is belonging to, and produced by,

" the volcanic lava-currents [1]." I had ever since the year 1767, or ever since my examination of the volcanic productions in Heſſe, obſerved the ſame phænomenon; and being convinced, by a variety of facts, that, beſides the ſalts and metals, many other foſſils receive a determined form by fuſion and cooling, as well as by their ſolution in aqueous ſolvents; I was the more ſtruck by this coinciding obſervation, and ſaw no reaſon why theſe problematical rocks ſhould not be henceforth conſidered as cryſtallized lavas. Accordingly I communicated in 1769 an account of the priſmatical baſaltes at Felſberg, and other places in Heſſe, to the Royal Society [2]; and, with ſome further particulars, to Sir William Hamilton, and to the Royal Society in Gottingen [3].

If it deſerves any praiſe, to have firſt hit upon a lucky hypotheſis, it cannot poſſibly be denied to Mr. *Deſmareſt*; and I may be

[1] Explicat. des Planches de l'Encyclop. liv. V. Par. 1768.

[2] Philoſ. Tranſ. vol. LXI. and Ferber's Letter V.

[3] German Memoirs of the Royal Society at Gottingen, Vol. I.

allowed to have some share in it, for being, in point of time, anterior to so many late discoverers of Volcanos and volcanic Basaltes; for having confirmed it by fair observations; and, finally, for having improved it by some new facts and views; which, in my late Account of the German Volcanos, I have laid before the public. Their chief purpose and tendency is, the conjecture, "that the prismatical basaltes, being, in those places "where I observed them, and in many "others, near or below the level of the sea, "are to be considered either as lava-currents, cooled in sea-water, or cooled in "themselves under ground without any "eruption [1]." The same reasons will stand for Messi. *Ferber* [2] and *Desmarest* [3], and for *me* [4], in respect to the first scientific descriptions of the various volcanic, or volcanico-marine, or volcanic-parasitical fossils,

[1] Account of some German Volcanos, 1776.

[2] Letters from Italy.

[3] Memoire sur les Volcans en Auvergne.

[4] See Account of German Volcanos, and the Notes and Index to this translation.

found

found in the several volcanos of Italy, France, and Germany; by which the pursuit of these enquiries and enlarged views, for the improvement of science and some of the mechanical arts, is made easy and popular.

Mr. *Ferber's* account of the Vesuvian lavas alone would give this publication credit. It is not only the first of that kind, but may justly be considered as a test and direction for other countries, which are destitute of still-burning volcanos. Probably it will be soon confirmed by the mineralogical accounts of Italy of Mr. *Guettard*, who travelled with *Ferber* through a great part of that country; and, though in some points he did not entirely agree with him, the public will be the better enabled by his accounts to judge of the truth and merit of their respective opinions.

From these late descriptions of the Italian and other volcanos, it appears, that there is an unthought-of variety of lavas and volcanic productions, different in their form, mixture, contents, solidity, nature, use, and situation. We are far, however, from being

acquainted with all their varieties. In reſpect to the whole ſurface of the earth, but few volcanos have been examined; and it is obvious, that different pre-exiſting rocks and mixtures, under various circumſtances and degrees of fuſion, conflagration, and cooling, muſt have produced as many different maſſes. Common loam, mixed as uſual with a little iron and ſand, produces, by an intenſe heat of fire in every kiln, a ſpecies of ſtone and vitrification, which bears a great reſemblance to common lavas. Let us alter the mixture, and add ſome more ſand or ſalts, the produce will undoubtedly prove very different. Let us think of Meſſ. *Wedgwood's* and *Bentley's*, or other china and glaſs manufactories; of the metallic furnaces, and of that infinite number of poſſible combinations; and we ſhall not wonder if, in future times, the great chemical fire of Nature ſhould be found to have produced many ſpecies of rocks, which hitherto we have little thought to be of a volcanic kind.

This leads me, 3, to *the ſub-marine volcanos and the new-raiſed iſlands.* The former, though

though the most singular instance of warring elements, have been scarce so much as spoken of, and we know very little of them; but what we know is sufficient to recommend them to our attention. They are very frequent, as appears by the banks of floating pumice-stones, met with and noticed by so many navigators. They have spent and exerted their power in many places, where new islands have been accumulated and raised by their eruptions; and may be nearer examined in the ocean and on the shores of these islands by such navigators as are Naturalists; nay, they may be traced even on the continent, where ancient volcanos are capped by marine strata; which is the case in Hesse and in those hills of Italy, which Mr. *Ferber* has noticed as being composed of alternate volcanic and marine beds. They must of course produce modifications of fossils, which the common volcanic eruptions above the level of the sea seem never to offer to the observer. The officinal pumice-stones, floating in the sea, are undoubtedly

doubtedly their production. The regular prismatical basaltes seem to be their work; and it is highly probable, that the petrified fishes are monuments of their heat, which very often has been observed to make the troubled ocean boil with violence in those places, where Pluto and Neptune strove for their kingdoms—

Quicquid delirant reges, plectuntur Achivi.

The nimble motion and known voracity of fishes when alive; their easy putrefaction and floating on the surface of the water when dead; and many other circumstances coincide to indicate—not a flood, which certainly would neither have drowned nor buried them under the water; but some sudden unnatural revolution in their own element, which must have killed and involved them at once in the sediments of the troubled ocean. On this account, many argillaceous slate-rocks, filled with petrified fishes, are to be considered as sub-marine or

as

as ſub-aqueous volcanic productions; nay, many calcareous ſlates, ſuch as thoſe at Bolca, Pappenheim, Eichſtaedt, Altheim, and Mount Libanon, are, for the ſame reaſon, to be ranked amongſt them—a circumſtance not highly favourable to thoſe Mineralogiſts, who, without having made proper obſervations, tell us too confidently, that the ſtratified limeſtone, without exception, conſiſts of decayed and diſſolved corals and ſea-ſhells. In reſpect to the limeſtone, I ſhall not for the preſent launch into Chemiſtry, by enlarging upon the hypotheſis; nor ſhall I dwell on the ſaltneſs and bitterneſs of the ſea, which may partly be aſcribed to ſimilar ſub-marine events; meaning only to recommend the above enquiries. Theſe, it is matter of ſome ſurprize, to ſee hitherto neglected equally with the examination of thoſe new iſlands, which, by earthquakes, or by volcanic eruptions, have been raiſed from the bottom of the ſea.

I had

I had frankly recommended these enquiries to the Royal Society of London, so long since as the year 1763. As Lovers of science might have therefore expected that greater attention would have been paid to them in this inquisitive age, and in an enlightened kingdom, so powerful at sea, and which sends many ships every year into the Archipelago and the Mediterranean; and which has generously employed, of late, expert navigators and able philosophers, at the public expence, to make discoveries in the remotest parts of the world.

Have these enquiries been postponed as trifling; and uninteresting? The inattention of the leading philosophers might start such an idea, and seems to imply some public prejudice against them. But this

[1] Specimen historiæ naturalis globi terraquei de novis e mari natis insulis & ex his exactius observatis confirmanda Græcorum & Hookiana hypothesi de montium & corporum petrifactorum origine. Amstelodami, 1763, 8vo. dedicated to the late Earl of Macclesfield, President of the Royal Society.

inatten-

inattention proves, at moſt, that ſcientific Mineralogy and Oryctology have not been, hitherto, ſo much and ſo generally attended to in England as in other parts of Europe. I am perſuaded that they require only to be exhibited to the public, to engage in their behalf that generous encouragement which has rendered the Engliſh Aſtronomers, Mathematicians, and Naturaliſts, every way ſuperior to thoſe of other countries. Upon a preſumption, that the time for their better cultivation in England cannot be very far diſtant, I have recommended ſome of the enquiries, here ſpoken of, to Captain Cooke, who is again to go on diſcoveries; and I recommend them to the public in general, with the ſame warmth, wherewith I made ſimilar propoſals many years ago. Whether I ſhall reap any advantage from them or not, may be indifferent to me; but in whatever proper manner they ſhall be attended to, I am ſure they will reward their Protectors, and enlarge ſcience, which, it is hoped, can never be indifferent to them.

So

So much for the present, of the progress, present state, and future improvement, of Natural Geography and Mineralogy. More might have been said on this subject, but it is sufficient to have pointed out the view, in which the present publication is to be considered by candid readers. I cannot finish without adding, that Mr. *Ferber's* style might have been more lively, and that my translation might have been more correct. I am sensible of this; but could not possibly, in the quality of translator, alter the style of a book, which is to stand by its contents, and was never meant to be a piece of eloquence. It was my chief attention, and my duty, to make it intelligible and useful. I have accordingly taken great pains to give the true sense; and have added explanatory Notes and an Index, which, it is presumed, will be acceptable. Nor have I been inattentive to language, and the correction of the press. If, however, any trace of incorrectness should remain, as it is justly to be apprehended there may; I request from my readers a part of

that indulgence for myself, which my correctors may have had for these faults; and this I dare flatter myself to be favoured with, as *I have no cause to suspect or to fear, That reasonable indulgence is fled from the breast of humanity.*

London,
March, 1776.

R. E. RASPE.

ERRATA.

The first sheet, from p. 1—16, having been rather too hastily corrected, the following gross errors should be taken notice of.

P. 1. *Vienna*, Sept. 23.—read *Venice*.
P. 15. *Crysolite basalt-columns*—read *crystallized*.

LET-

TRAVELS

THROUGH

ITALY.

LETTER I.

Vienna, Sept. 23, 1771.

I HAVE at last the pleasure of writing to you from that charming country which I was always so desirous to see. Even the small tract which I have travelled over, between *Goerts* and this place, convinces me it deserves the praises given by travellers, of its soft climate, natural productions, and beauty, wherein it certainly surpasses almost every part of Europe. I am yet a stranger at Venice. However, at the expence of my curiosity, I sacrifice some hours to the pleasure of conversing with you. I shall be more than rewarded, if the remarks on my journey from *Vienna* hither should afford to you a part of that satisfaction, which the

contemplation of nature yielded to me as I wrote them down; and, according to your desire, I will, as I proceed in my journey through Italy, describe to you its natural curiosities, especially those which belong to Oryctography and physical Geography. The many other curiosities of this admirable country have been described by others. But I shall use the freedom which you have allowed me, and write without spending much time in an attention to elegance. You will kindly forgive me if I should now and then involuntarily be wrong. You know, by your own experience, that a crowding multitude of objects very often distracts and weakens the attention of the best Naturalists, and that travelling leaves neither time nor opportunity for experiments and methodical dissertations. I write to a friend, whose kindness I have experienced; and as you intend to travel in Italy, you will easily correct my errors; my purpose is, to tell you what I have seen; and what probably will be left unseen by me, or insufficiently examined.

When you have set out from *Vienna*, you see, on both sides, in Hungary, Austria, and Steyermarck, long chains of connected and calcareous hills, formed like waves, which, all the way from *Vienna* to *Wippach*, I passed or had near me. Now and then they rise remarkably high, or stretch into the country, divided by great valleys and wide-extended plains, which are watered and intersected by rivers.

rivers. The excellent Imperial-road is made over these hills.

At *Wippach*, two stages distant from *Guertz*, the mild climate of Italy begins; and the above mentioned hills run to the left through the *Friual*, along the Adriatic Sea, *Istria*, *Dalmatia*, and the *Archipelago*; but on the right they join the *Tyrol-Alps*, connected with the *Tridentine* and *Veronese* mountains. Between these diverging hills there is a flat plain country all the way to Venice, planted with vines, maize, buck-wheat, millet, and *Holcus Sorghum*. There appears hardly any corn.

The lime-stone of these hills is, for the most part, light-grey, now and then changing to a darker colour, either in the whole mass, or in blackish nodules and masses interspersed with it. There are some hills of an entirely black limestone; its hardness is very different from that in Austria, Steyermarck, and Crayn. There are different sorts of good marble dug out of these hills. Its grain is commonly fine, compact, and sound; rarely scaly, never saline. It contains petrifactions of greater and lesser sea-shells, but in small numbers.

These hills are in *Austria* up to the limits of Steyermarck, uncovered by forests, and for the most part planted with vines and corn; but in *Upper-Steyermarck* they rise to a remarkable elevation, covered with fir-wood, and separated by dales, overgrown by deciduous trees. In *Under-Steyer* and

Crayn I saw them cloathed by birch, beech, and chesnut trees, a few excepted, which were cloathed by firs.

They consist more or less of horizontal and large beds or strata; and they are truly *superincumbent mountains*, set in all these parts upon a foundation of schistus or slate, which constantly runs under ground. This schistus is either a true clay-slate, of a blue or black colour, or a horn-slate, composed of quartz and glimmer, now and then offering some clayish mixture.

I had almost at every step an opportunity of being convinced that this schistus constantly ran under the visible lime-stone hills. Sometimes it rises bare above ground, and continues so for some distance; but soon after it is hid again under its calcareous covering. The lead-mines in Steyermarck, and the mercury-mines at Hydria, are sunk into this schistus, through the superior lime-stone-strata. I see by some accounts and fossils from Tyrol, which you have communicated to me, that this adjacent country is of the same construction; and though the ore in the Steyrish iron-mines near *Eisenaerzt* is found in limestone, there is no doubt but schistus would be found in a greater depth. I shall give you a particular account of those places in Austria, Steyer, and Crayn, in which I observed that quality of these hills and other objects worth your attention.

At

At *Feyſtriz* on the *Moor* near *Pegau*, in *Steyermarck*, there are ſome lead-mines belonging to Baron von *Heipel*. The mines are the following:

1. The Pauls Haupt-Forder and Weather-Shaft.
2. S. Martins, Haupt-Shaft.
3. S. Nepomues-Tunnel.
4. Mary and Melchior Tunnel.
5. Eliſabeth Tunnel; and
6. New-Barbara-Schaft.

They yield, according to what I was told, every year from 4 to 5000 tun of lead-ore, containing from three-quarters of an ounce to one ounce of ſilver. The ore is a fine cryſtaliſed galena or glance, found in a vein of quartz and calcareous-ſpar, running through a clayiſh blue ſlate-rock, by the higher calcareous and fir-grown mountains. The mines or the ſhafts and tunnels are ſunk in the valley ſcarce above the level of the *Moor*, which river is very near. They are ſunk in the ſame horizontal line in which the limeſtone ends, and the inferior ſlate begins. The Pauls-ſhaft is worked down in this ſlate to a depth of fifty-two fathom. This ſhaft is drawn and emptied by horſes; even its water and pump-engine are managed by horſes, till an engine-wheel, which is preparing, be ready and ſet to work. The ſuperior limeſtone expoſed to day is without any veins, of a compact and ſound grain, and containing ſome petrifactions.

At *Votſtrberg*, five or ſix leagues diſtant from *Feiſtriz*, are coal mines; but there are better ones at *Luim* in *Upper-Steyer*, ten miles further.

The river *Moor* accompanied me in my road from *Krigloch* to *Merzhofen*, *Brugg*, *Radelſtein*, *Pegau*, *Graetz*, and ſtill further. The valley, wherein it runs, ſeems to have been excavated by its violently breaking through the adjacent calcareous hills, or by their ſucceſſive corroſion.

At *Graetz* I examined a fine collection of natural curioſities in the college of Jeſuits. It is richly provided with Minerals and Inſects. The acquaintance of P. *Biwald*, a good botaniſt, was very agreeable to me.

Between *Ernhauſen* and *Marburg* I deſcended on the ſloping of a high grey-limeſtone hill. The detached ſtones on and near the road contained ſome marks of petrified ſhells, and nodules of black limeſtone. The following valley continued beyond *Marburg* and *Faiſtriz*, which place is different from the above *Feiſtriz* near *Pegau*. All along this valley there was no limeſtone to be ſeen; but the bare places and the detached ſtones heaped on both ſides of the road ſhewed a blackiſh and blueiſh ſlate, together with a horn-ſlate compoſed of quartz and glimmer.

On this ſide of *Faiſtriz* I aſcended again, and found at the ſummit of the hill the grey limeſtone continuing. It contained ſome, though but few, ſea-ſhells, as oſtracites, pectiniles, and the like. It

was

was of a compact grain; but part of the uppermost beds was spungy and porous like tophus, and ferruminated with blunt pebbles and other loose stones. In other places these superior beds offered oblong scaly pisolites cemented together. Now and then black limestone was found inclosed in the grey; and, partly indurated, had got the nature of hornstone-rock. I saw likewise black limestone with white veins. Near *Faistriz* and between *Ernhausen* and *Marburg*, I observed different detached pieces (*geschiebe*) of a blueish grey trapp, containing quadrangular sherl-crystals, of a remarkable length and bigness.

Between *Faistriz* and *Cornuwiz* the following stones offered on the road. 1. Large red garnets in green sparry sherl, and among them several scaley ones of a micaceous or glimmery contexture. 2. Black feather, or strahl-sherl, in large pieces inclosed in white quartz. 3. Green jasper. I know very well that detached stones give no great evidence; but they give some hints of the nature of the neighbouring hills; and if heaped near the roads as repairing materials, there is good reason to suppose their quarries very near, especially if they do not appear under a blunt form, but pointed and fresh-broken.

The limestone appeared here to be covered by a thin bed of breccia or pudding-stone, composed of blunt pebbles cemented by lime.

Between *Zila* and *France* I found near the road horny indurated red iron-clay or Bolus, with quarzy veins.

Between *France* and *Ufwold*, near to the limit pyramid of Steyermarck and Crayn, and the triumphal-arch, rifes from under ground a black table-flate hill. It is of a remarkable elevation, and continues till near *Lanbach*; however the limeftone, which covered it, appears on both fides.

Similar flate-hills rife above their calcareous roof, between *Laubach* and *Upper Laubach*. In the foreft near *Laubach* I found, on the furface of the hill, a fmall bed of reddifh fea-fand, dug out as materials for repairing the road.

Between *Upper-Laubach* and *Hydria*, the flate-hills are covered by common limeftone, which here, for a long way, was light-grey, and afterwards changed to a black colour.

Hydria is a fmall irregular place, fituated in a deep valley, on both fides of a river, which bears the fame name; it is furrounded every where with high towering mountains of black limeftone. In this valley the black flate rifes naked from under ground, between forty-five and feventy-five degrees, having limeftone both in its hanging and in its hading fide. The famous rich mercurial mines are funk in it; and the flate, more or lefs penetrated by mercury and cinnabar, is nearly twenty Hydrian fathoms deep, extending into the field about

about two or three hundred fathoms. The dipping of this rich flat-work is variable, and often irregular. The perpendicular depth of the principal ſhafts is about one hundred fathoms. I forbear to ſpeak of the ores to be found here, becauſe you have them in your collection, having been beſides deſcribed already by Mr. *Scopoli*, in his treatiſe *de Hydrargyro Idrienſi*. I have but a ſingle remark, and that is, that I have ſeen the halotrictrum of Mr. *Scopoli*, adherent to the ſides of the mines, and fairly reddened by cinnabar. They conſider here their common melting and uſtulation of the mercurial-ores as an arcanum, and accordingly do not allow any ſtranger to examine their ſublimation-houſe, though even its exterior form undoubtedly, and at firſt ſight, proves their method being the very ſame as that which is uſed at *Almaden* in Spain; and has been very minutely deſcribed by Mr. *Juſſieu*, in the memoires of the royal ſociety at Paris. This method is far from being perfect, and above any improvements. But probably they do not think ſo; elſe there could be no poſſible reaſon for their myſtery in ſo common a manipulation. Nothing is more oppoſite to the progreſs of the ſciences, and even to the intereſt of ſtates, than ſo ſingular a myſteriouſneſs.

The example of the French Academy, publiſhing the, till now unknown, manipulations of Artiſts and Manufacturers, ſhould be to other nations

nations an inducement of praiſe-worthy and public-ſpirited imitation; and this the more ſo, as that Academy acts by generous principles, explained in the Preface to the *Spectacle des Arts*; and as ſuch, an imitation would certainly prove equally ſucceſsful and ſerviceable to the imitators, and to the generality of mankind. The quickſilver being beſides ſo very plenty at *Hydria*, and, except *Zweybrutken* and the *Palatinate*, ſcarce any where elſe to be found in Europe, I do not conceive for what good reaſons they treat its melting with ſo much ſecrecy in reſpect to ſtrangers who are deſtitute of that commodity. Nature gave it to Hydria in ſo aſtoniſhing a quantity, that it would be ſufficient to the wants of Europe, and even to the demands of America, if, to keep a certain price, they did not put its meltings and ſales under certain regulated reſtrictions. They might, if they pleaſed, at Hydria, even underſell every competitor. We have long ſince given in Sweden a conſiderable premium on the abridgement of our uſual copper-melting, and accordingly we have invited to it all the Swediſh and foreign chemiſts; yea, we have given patents of nobility, and other great rewards, to the celebrated *Kunckel*, though his propoſals of a new proceſs did not entirely anſwer our expectations. Nevertheleſs, our copper is the beſt in Europe; and we do not apprehend at all to learn

learn its melting and parting in Hungary, or other countries abroad. Every improvement of such a nature is to be expected from chemistry and metallurgy; but how can that be obtained, if even a sight of the common manipulation is forbid to those who might be perhaps possessed of the convenient knowledge? I have seen the mercurial-mines in the *Palatinate* and *Zweybrucken*; I have observed the usual melting; I am acquainted with the process practised at *Almaden*; and, what is above all that, chemistry and metallurgy have taught me the principles of this operation. I could wish only that we might happen to discover in my country mercurial-mines as rich as those at Hydria. I am pretty well convinced our theoretical melters would not be at a loss how to part them.

The limestone hills near *Panina* and *Alderſberg* offer several subterraneous grottoes incrustated by figured stalactites. Some of them run and extend several miles under ground, and receive the waters of different rivers. To give an instance of that, I ought to tell you, that the *Poig*-river falls, and is lost, in the cavern near *Adlerſberg*. The famous *Czirnity*-lake, two hours journey distant from *Planina*, is in one year's time navigable, fished, planted, and reaped; and moreover it is said to empty its water into such caverns.

Between

Between *Wippach* and *Meſtre*, where I embarked for *Venice*, I paſſed through fertile plains, richly planted with vine, fig, and mulberry-trees, maize, and ſeveral other plants of warmer climates. In proportion as they were unuſual, they ſeemed the more charming to me. The ſameneſs of their aſpect, ſo diſagreeable in other flat countries, was not at all tireſome, ſince every ſpot of ground was tilled to a triple harveſt, being planted with wheat, or maize, and with mulberry and Lombardy poplar-trees, in regular rows, to ſupport the grapes and their picturesque feſtoons, cluſtering from tree to tree. Italy will certainly preſent many more proſpects of that kind; and I ſhould enjoy them better in your company.

LET-

LETTER II.

Padua, Sept. 30, 1775.

I Arrived at *Venice* when moſt of the gentlemen whoſe acquaintance is deſirable to me were in the country. Therefore I have made a trip to *Padua*, *Vicenza*, and *Verona*. It is three days ſince I arrived here, and, as far as my opportunities will permit, I will give you an account of the principal curioſities of this place, which lie in our way, and have not been deſcribed before.

The *Botanic Garden* is one of the fineſt and richeſt I ever ſaw. Its plan is convenient, proper, and elegant. The late profeſſor of botany, *Pontedera*, has greatly improved it, under the direction of the *Riformatori dello Studio di Padova*; and the preſent learned profeſſor, *Giovanni Marſili*, author of a treatiſe *de fungo Carrarienſi vel crepitu Lupi*, has a great correſpondence with the chief botaniſts of Europe. To keep plants of warmer climates in the beds of the garden, they have contrived wainſcot ſhutters with glaſs windows,

dows, which, in winter-time, are laid over the fields, and supported by moveable poles six feet high.

The *husbandry* or *œconomical Garden* is an excellent useful modern establishment, directed by the celebrated Mr. *Pietro Arduini*, now *Professor Oeconomiæ ruralis*. The main object of this garden is, to have at hand, for experiments in agriculture, œconomy, dying, &c. convenient quantities of œconomical plants and trees. Mr. *Arduini* has published already a volume of his observations. It is a very promising establishment. Mr. *Arduini* follows the Linnean system.

The *academical collection of natural curiosities* contains the old cabinet of the immortal *Antonio Valisneri*, late professor of natural history at *Padua*. He was succeeded in that place by his son *il Cavaliere Antonio Valisneri*, who is already much advanced in years.

The collection is somewhat impaired by dust. Besides, it did not answer my expectation, either on account of the quality or the number of its curiosities. What I most delighted to observe was petrified shells in red jasper, different specimens of Brescian agates; Sicilian agates; red and white spotted porphyry, from *Cricetta*, in the Venetian dominions; and a piece of an anchor-cable incrustated by a calcareous tufo-stone, which contained natural unpetrified shells. They shewed me likewise two

pieces of native iron, one from *Steyermarck*, the other from *Johan-Georgen-Stadt*, in Saxony. I do not depend upon, nor anſwer for, their authenticity. The perſon who ſhewed this cabinet was an apothecary, a diſciple of *Pontedera*, and poſſeſſed of a good collection of dry plants, petrifactions, and lavas, found in the neighbourhood. Among ſeveral other curioſities, he ſhewed me, 1. Grey lava, ſprinkled with ſmall black ſherl-points, covered on one ſide with the pretended black Iceland agate, (*Cronſted, Mineral.* §. 295) found near *Monte Catajo*, near *Padua*. 2. Black, very compact lava, with green ſherl-nodules, which reſemble the chryſolite, from the ſame place. 3. Chryſolite Baſalt-columns, from the ſame place, and other Euganean hills, near Padua.

The *chemical Laboratory*, at *Padua*; together with the hall, and the collection of minerals, has been but of late eſtabliſhed by the preſent profeſſor of chemiſtry, Count *Marco Carburi*. He was born in Greece, and travelled ſome years ago, at the expence of the Republick, to the mines in Saxony, on the Hartz, and in Sweden, where, in the year 1762, I got acquainted with him at *Upſal*. His brother was phyſician to his Sardinian Majeſty at Turin, but has lived for the laſt year at Paris.

The *anatomical Theatre* is ſmall and dark, though anatomy be, perhaps, no where better taught than

than at Padua. The celebrated Mr. *Giov. Bat. Morgagni*, a German, though very old, continues his leſſons. Profeſſor and doctor *Caldani* has a fine collection of anatomical preparations in wax.

Mr. *Vandelli*, profeſſor of ſurgery, has a ſmall collection of petrifactions, from the Vicentine and Veroneſe mountains. It was made by his ſon *Domenico Vandalli*, now profeſſor of botany at Liſbon, who lately has publiſhed

Faſciculum plantarum rariorum, printed at Liſbon, 1771:

and has given ſome hopes of a general natural hiſtory of Portugal, and ſome remarks on the Milaneſe mountains. His treatiſe

De Thermis agri Patavini cum Bibliotheca Hydrographica Padua, 1761. 4*to*.

is an uſeful performance; and

Conſpectus Muſei Dominici Vandelli,

kept at his father's, is inſerted into the

Novelle letterarie di Firenze, and into the

Gazetta medica del Sr. Dottore Pietro Orteſchi, *n.* 2. 1764.

At a diſtance of eight Italian miles from Padua, is the fine villa of Mr. *Filippo Farſetti*, a *nobile di Venezia*, called *Sala*. There is building now a palace, decorated with the fineſt marbles and granite-columns, which are tranſported hither from Rome. His botanic garden is extremely magnificent, and very rich in the ſcarceſt plants.

The

The *Paduan-hills*, which lie free and isolated, and are known under the name of *Montes Euganei*, consist of lavas of ancient extinct volcanos, never mentioned by any historian. These lavas are of a red, black, grey, and whitish colour, and commonly contain a great number of white crystalline garnets, and black sherl-nodules. Being very common and hard, they are, together with the broken basalt-columns, employed in the pavement of almost every street at Padua and Venice. In one of my next Letters I shall speak of them more particularly. Besides these isolated volcanic hills, the calcareous Alps run through the Paduan territories.

I Bagni d'Albano, described in the above treatise of Mr. *Vandelli*, are about twenty miles distant from Padua. An Englishman, Sir *John Strange*, who, on account of his health, has lived in this country for several years, has exactly examined all these parts *, and written a description of the fossils and lavas found thereabouts and in the Euganean hills, which, together with that collection, he has designed for the Paduan cabinet of natural history.

* His account of two giants-causeways, or groups of prismatic basaltine columns, and other vulcanic concretions in the Venetian state in Italy, together with two engravings of *Monte Rosso* and *il Monte di Diavolo*, was presented to the Royal Society in 1774, and is inserted in *Phil. Transact.* vol. lxv. part 1. for 1775.

LETTER III.

Verona, Oct. 5, 1771.

I CAME by the way of *Vicenza* to this place; therefore I entertain you firſt with my Vicentine obſervations.

I got there the valuable acquaintance and friendſhip of an able naturaliſt, Dr. *Antonio Turra*. He has a fine collection of foſſils, or petrifactions, found in the Vicentine calcareous mountains, but eſpecially in the *Montes Berici*, and *Monte Brendola*. His Herbary is likewiſe conſiderable; and he has almoſt finiſhed for the preſs a *Flora Italica*, after Baron *Linneus's* principles. He would have publiſhed it, if the many difficulties which attend every literary publication in Italy had not hindered him. His inſects alſo are worth ſeeing.

At *Valdagno*, twenty Italian miles diſtant from Vicenza, lives Dr. *Antonio Martini*, a good phyſician, and an attentive collector of the natural productions of his country.

At *Vicenza* I had the honour to wait on the Biſhop Monſignor *Marco Cornèr*. He has a rich bota-

botanical garden and library, and is a fond virtuoſo in botany, as well as other parts of natural hiſtory. Before he came to *Vicenza* he lived at *Morano*, and left there marks of his taſte in a botanic garden, which is now decaying. His Vicentine garden is ſituated on a high hill, on the road to *Madonna di Monte Berico*; and that hill is throughout an heap of accumulated volcanic aſhes, of a dark-brown colour; containing, very frequently, a white ſort of chalcedonick-nodules, which commonly are hollow within, but now and then are filled with water. They appear under the form of blunt round, or elliptical pebbles, from the bigneſs of a pea to the diameter of about an inch. There is good reaſon to ſuppoſe that theſe pebbles and nodules have been formed and filled with water in the holes of this cinereous hill, after it was accumulated by rain or ſnow water ſoaking through its ſpungy ſubſtance. They make rings of theſe ſingular chalcedonick-pebbles; and I ſaw two in the poſſeſſion of Dr. *Turra*, which, by having been worn for ſome time, had loſt and evaporated their water, probably by ſmall imperceptible cracks; though there are ſeveral of theſe ſtones which never loſe it. There are ſundry other volcanic-hills in Vicenza, containing ſimilar chalcedonick, or opal-like *Enhydros*. In that beforementioned, theſe pebbles are found in the volcanic aſhes, exactly as the chalcedony and zeolite-no-

dules lie buried in a bed of dark-brown earth, in the iſland of *Farroe*. May not this earth-ſtratum at Farroe be likewiſe of a volcanic kind?

The *Academia d'Agricultura*, at *Vicenza*, is planned out for the improvement of huſbandry, the culture of ſilk (greatly flouriſhing hereabout), and œconomy in general. Dr. *Turra* is its perpetual ſecretary.

Verona is a very delightful place. Here is much good-breeding, much chearfulneſs, and much taſte in ſeveral parts of literature. The road from Padua hither is undoubtedly the moſt pleaſing in Lombardy. On the right hand, you ſee, at ſome diſtance, the Alps, which ſeparate Italy and Germany, or the Paduan, Vicentine, and Veroneſe hills; but on the left, a flat, rich cultivated country, extending to the Apennines, behind Bologna. I do not entertain you at this time with the Vicentine and Veroneſe mountains, belonging to the chain of Alps which ſeparate Germany from Italy; but, in general, I can tell you, that they are of a calcareous nature, furniſh fine red, yellow, and variegated marbles, and have been ſhattered in former times by violent volcanos, as evidenced by a great variety of lavas, and other volcanic productions. Near *Roveredo* and the *Tridentine*, is *Monte Baldo* *, famous

* They dig in *Monte Baldo*, a yellow violet ſpotted marble, reſembling the Brocatello di Siena. The green colouring

for its rare plants, described by Mr. *Seguier*, in his *Flora Veronensi*, when he lived with the celebrated *Maffei*, at *Verona*, before he went to *Nismes*. Another hill, *Monte Bolca*, in the Veronese, is equally famous, on account of its numerous petrifactions and fine ichthyolites.

Spada described, in *Corporum lapidefactorum agri Veronensis Catalogo Veronae*, 1744. 4*to*. his collection of petrifactions, which I have seen at Mr. *Seguier's*, at *Nismes*, who acquired it after the owner's death, and augmented it very much. An apothecary, Mr. *Giulio Cesare Moreni*, at *Verona*, has likewise a rich collection of the *Bolca*-fishes and petrifactions; together with a considerable Herbary of Alpine plants; of *Monte Baldo*, which probably will be bought by the Archduke of Tuscany; Mr. *Moreni*, by his private circumstances, being forced to sell them. Among the petrified fishes of this collection, is the flying-fish, some Brasilians, and such as are not found in the Adriatic or the Mediterranean sea; the *Pinna Marina*, bones of exotic animals, and foreign plants, petrified and moulded in calcareous slate, which, by friction, gives a disagreeable smell. Mr. *Moreni* pretends to have found on *Monte Baldo* several

ing earth, or green painters clay, is dug near Brontonico, on the northern side of Monte Baldo, and is a considerable object of trade.

plants, unnoticed by Mr. *Seguier*; for example, the white and red variety of *Alyssum Pyrenaicum*. This may be, without lessening the credit of Mr. *Seguier*, who, grown old, continues to live like a true philosopher; and has seen, with cool indifference, a Dutchman publishing a new edition of his *Botanical Library*, and impudently selling it as his own work, supposing the author gone

Unde negant redire quenquam.

I am indebted to Mr. *Seguier*, for many useful directions and recommendations in Italy. Besides the before-mentioned collection, Mr. *Gasparo Bordoni*, and the apothecary *Vincenzo Bozza*, at Verona, are likewise possessed of the fishes and curiosities of *Monte Bolca*. The latter of these gentlemen has published a valuable chemical treatise, *De aquis medicatis martialibus Veronensibus*.

LET-

LETTER IV.

Venice, Nov. 2, 1771.

I Returned hither on the 7th of October, after my journey to *Padua*, *Vicenza*, and *Verona*; and have had, ſince, the pleaſure to make ſome agreeable acquaintances, and to ſee here, and in the neighbourhood, whatever is remarkable in Natural Hiſtory.

Mr. *Gio. Arduini*, *publico ſopraintendente d'Agricoltura in ſtato Veneto*, is a very learned man in Mineralogy, Metallurgy, and Chemiſtry. I can rank him amongſt my friends. You may gueſs at his ſkill in Agriculture and Huſbandry, by his uncommon exertions in the *Magiſtrato d'Agricoltura*. It is he that propoſes, adviſes, and records the greater part of its undertakings; it is he that, in ſome reſpect, is the *fac-totum* of this college, for this, like other Venetian public departments, is filled by over-great people, that is to ſay, by noblemen. He aſſiſts likewiſe, according to his function, the *Magiſtrato delle Miniere*. The taſte of huſbandry is at preſent ſo general in

the Venetian ſtate, that there are publiſhing many uſeful obſervations; and they begin to ſet the ſame value upon agriculture, with which the Romans, in the brighteſt luſtre of their glory, honoured that ſcience. The Oeconomical academies, or ſocieties, at *Udine*, *Vicenza*, and *Breſcia*, ſend their Diſſertations to the *Magiſtrato d'Agricoltura*, and are rewarded for the beſt, with conſiderable prizes.

The profeſſorſhip of agriculture and practical oeconomy at Padua, given to Mr. *Pietro Arduini*, is a new eſtabliſhment, and a conſequence of this taſte. But I ſhall rather dwell on Mr. *Gio. Arduini*'s knowlege in mineralogy, which proved very profitable to me. During a long time he directed ſome mines in the Tridentine territory, and at *Schio* in the Vicentine. Afterwards he got the inſpection of the mines of *Gerfalco* and *Montieri*, in Tuſcany, near *Siena*; where he lived two years, till he was ordered back again into the Venetian ſtate. Wherever he lived, he was aſſiduous in collecting and obſerving. Some of his obſervations have been publiſhed, in two Letters, to Mr. *Antonio Valiſneri*, at Padua, in the *Raccolta d'Opuſcoli Filologici preſſo Simone Occhi*. Several others have appeared in different volumes of the *Giornale d'Italia ſpettante alla Scienza naturale*; printed at Venice; but ſtill the greater part is

kept

kept in his library. Their being publiſhed would certainly prove an advantage to the ſciences, eſpecially if his maſterly hand ſhould bring them to due and ſyſtematical connection. He was ſo kind as to allow me to peruſe them; and whenever, in the Paduan, Vicentine, and Veroneſe territories, I had an opportunity to examine the places by myſelf which he had obſerved before, I have found nature and his obſervations exactly correſponding. By this means, I am the more convinced, that the calcareous hills, in the Paduan, Vicentine, and Veroneſe regions, belonging to the Alps, which ſeparate Germany and Italy, are conſtantly, as in Auſtria, Steyer, and Crayn, ſuperincumbent to ſlate, on which they have been accumulated. He aſſures me likewiſe, that, according to Mr. *Targioni Tozzetti's* obſervations in Tuſcany, Prof. *Baldaſſari's* treatiſes in the *Acta Academiæ Sienenſis*, and his own inſpection, the nature of a part of the Apennines is exactly the very ſame. Even the ſaline marbles at *Carrara* and *Seravezza* are ſaid to be ſuperincumbent on ſlate. I hope to verify all this by my own obſervations, recapitulating in a few words, that ſlate is conſtantly running under theſe limeſtone-hills in the Venetian State; that, from beneath the calcareous beds, even from beneath the ſlate, there have been in

former

former times volcanic eruptions, which, raising many lava hills, and occasioning in the calcareous beds many fissures and various sloping dippings, have left every where incontestable marks and evidences of their former devastations, though unnoticed by the most ancient historians.

I am obliged to make you equally acquainted with P. *Alberto Fortis*. He is a white-friar, of the Augustine order, and a man of a lively temper, and much ingenuity. He is possessed of solid science and principles in Oryctography; has travelled in Dalmatia, and lately published *Osservazioni sopra l'Isola di Cherso ed Osero*. A great number of his performances are inserted in the *Giornale d'Italia*, and the *Europa Letteraria*, two periodical reviews, publishing at Venice.

Padre *Vio*, a Dominican priest in the convent *S. Mattia*, at *Murano*, near Venice, had some time ago a fine collection of petrifactions and natural curiosities; but he has sold it to Lord *Bute*, who has travelled over Italy as a great connoisseur and friend of natural history and the finer arts of the ancients. But Padre *Vio* has already begun a new collection; and he shewed me a variety of small microscopic shells and lithophytes, either natural ones found in the sands of the Adriatic, or petrified and gathered in the Vicentine

centine and Veroneſe hills, which with much pains he has collected, and with equal care glued on a black paper-ground. Several ſpecies ſeemed to be entirely new, and never obſerved. He ſhewed me ſome petrified ſhells in a red jaſper, ſprinkled with quartz, found near Breſcia; where, as in Vicenza and Verona, the upper ſtratum of the calcareous hills commonly contains a great variety of red and black jaſper and common flint, diſpoſed in ſmall beds, which are called *la Scaglia*. His mouldings and ammonites in a grey hornſtone *(Petroſilex)* from the iſland *Cerigo*, in the Archipelago, ſeemed to me very ſingular.

Signor *Giacomo Moroſini*, a nobleman, has a fine botanic garden near Venice, and a cabinet of the three natural kingdoms; which, though not very numerous, contains ſome very valuable pieces. I ſaw there pretended black Iceland agate *(Cronſted. Mineral.* §. 295), and another ſpecies of that kind, of a blue colour; ſo perfectly reſembling blue iron-ſlags, that I doubted its authenticity, till ſeveral connoiſſeurs, whoſe veracity I cannot ſuſpect, unanimouſly aſſured me of its being very frequent, together with the black ſpecies, among the volcanic productions in the Venetian State; I ſaw, likewiſe, calcined bones and fragments of human ſkulls (ſuch they ſeemed to be) in a red calcareous and jaſper-

like indurated ſtratum, from the iſland of *Cherſo* *. Of theſe, *P. Fortis* has given an account in the abovementioned treatiſe. But what ſeemed more ſtrange to me was, to meet here with a yellow zeolite, from *Schio* and from *Tretto*. It is the very ſame ſpecies which we have in our gold mines at *Edelfors* in *Sweden*. You ſhall have your ſhare of all the double ſpecimens of foſſils which I gather in Italy; but do me the favour to ſend directly to Mr. *Arduini* ſome pieces of the ſingular gold-ore from *Nagyag*, and of the gold pyrites from *Facebay*.

Mr. *Franceſco Pataroli* is a great friend of botany. Accordingly he has a convenient garden and library. I can ſay the ſame of Dr. *Seſler*, a German phyſician; and of Mr. *Pelegrino Gozzi*, an apothecary. Theſe botanical acquaintances give me an opportunity to tell you, that, with Mr. *Marſili's* permiſſion, I have lately reaped in the botanical garden at Padua a fine crop of rare plants. Several of the duplicates are for your Herbary. Pity it was that autumn had left but few in flower. But I hope to make up for this next ſummer. I have been ſeveral times botanizing at *Lido*. This is the next place in the Venetian *Terra firma*. Many ſcarce plants are there natural

* Specimens of theſe Cherſo bones have been preſented to the Britiſh Muſeum.

inhabi-

inhabitants. Such is the *Apocynum Venetum*. The late Mr. *Zannichelli*, a druggiſt at Venice, has given deſcriptions of many others; and his collection of natural curioſities has been incorporated into the Academic Muſeum at Padua. I met lately with the *Valiſneria*, *Najas*, and *Marſilæa quadri-folia*, in the *Brenta*, and in the fields near Padua.

Mr. *Franceſco Griſelini* is a man of much reading in many ſciences, particularly in natural hiſtory, which he has ſucceſsfully evidenced in his *Giornale d'Italia ſpettante alla Scienza naturale*. This excellent review gives an account of all Italian books, diſcoveries, and eſtabliſhments, concerning natural hiſtory, chemiſtry, huſbandry, and œconomy. There have appeared already ſeven volumes in 4to. printed by *Milocco* at Venice. Mr. *Griſelini* not only is author of this, but likewiſe of the equally uſeful *Giornale di Medicina*.

The other Review, *Europa Letteraria*, is upon a larger plan. It deſerves to be recommended, for its intrinſic value; and to be noticed, on account of one of the chief authors, who is a young, handſome, and very learned lady, Miſs *Elizabeth Caminer*; whoſe amiable ingenuity, parts, and knowledge in the French and Italian languages, have been juſtly admired in ſeveral ori-

ginal works, and in a great number of plays, which, in her tranſlations from the French are exhibited at *S. Angelo*, in *Venice*.

After ſo much literary news, there remains a good deal to be ſaid of ſeveral curioſities in this city.

I ſhould have ſaid nothing of the *Arſenal*, but its large piles of iron-guns, as it were, bring me to it. They are caſt in *Breſciano* and *Bergamaſco*, and are ſo remarkably deficient, and full of holes and cracks, that the government, on the repreſentations of general *Pattiſon*, who is an Engliſhman, has reſolved to reject them as unfit for ſervice, and to procure others in their place.

Probably they will be ordered from Sweden, our iron-manufactories having been juſtly and ſtrongly recommended by our conſul, Mr. *Delorthe*. The iron ore in *Breſciano* and *Bergamaſco* being the ſame as the iron-coloured which we have in Sweden, (*Cronſt. Mineralog.* §. 203, 211, & 212.) or partly the ſame ſteel-ore (*Stahlſtein*, or *Pflintz*) which yields the Steyermarck-ſteel (*Cronſted. Min.* §. 207.) the defects and bad quality of thoſe guns, are merely to be aſcribed to an imperfect ſmelting and manipulation.

I paſs

I pass over the *Coral Manufactory*, as having been exactly described in the *Giornale d'Italia*, and agreeing with a like manufactory at *Leghorn*.

The manipulation of *grinding* and *polishing Diamonds* is here the same as at *Amsterdam*.

The *Crystal Manufactory* at *Venice*, the *Looking-glass Manufactory* at *Murano*, and the *Glasieries* at the same place, are less remarkable at present, since good ones are now common every where, and the French, at *S. Gobin*, by casting, produce looking-glasses of a larger surface than the Venetian practice of blowing will allow. In the *Crystal Manufactory*, they make not only different *glass enamelling fritta's*, which sell all over Europe, but likewise a white fritta, for the Venetian buckle-manufactory. The *Murano* glass-makers furnish Italy with bottles and glasses; they make the thin Florentine-oil and wine-bottles, at so cheap a price, that they bear the carriage by mules to the other side of the Apennines.

The *refining of borax* and *camphor*, the *sublimation of mercury* and *cinnabar*, &c. have ceased to be secrets of the Venetians, as being now common in *Holland*, at *London*, and *Paris*. They continue still to make *theriaca* in convents and in apothecaries shops.

There

There is a good *China-pottery* at *Venice*. They fetch the clay from some low hills in *Territorio di Tretto, Vicariato di Tiene*, where this clay-bed covers old *silver mines*, which are sunk in slate and volcanic ground. The same clay is employed in the *China-manufactory* at *Florence*. It is good, fine, and white enough, but wants that soft saponaceous and micaceous substance, which is peculiar to the best *China-clays*. A whiter clay of the same kind has been lately discovered in a valley near *Bergamo*, but it is likewise destitute of this *glimmer*. The cases of another apyrous earth, wherein the china is set in the fire, had a grey colour, sprinkled with white spots like porphyry.

The Italian Naturalists pretend, that the Adriatic sea, instead of diminishing, continually increases. Among several evidences, they support this opinion by a fact which cannot be doubted; that is, digging at Venice, they very often meet in the ground with three different pavements, two of them lying below the present paving. This has been observed, for example, in the *Piazza S. Marco*, and may have been occasioned by the growing and heightening level of the sea. Certain it is, that, after heavy rains, and in the autumn, when stormy weather raises the water, they very often are under the necessity to go in boats from one coffee-house to another. But might not the collective

collective burden and preſſure of a large ſtone-built city, have lowered and ſunk the yielding ſwampy-ground whereupon it ſtands *?

The quarry-ſtones uſed at Venice in the maſonry of churches and palaces, private houſes being commonly built of brick, are a white lime-ſtone, brought hither from Iſtria, and called *Pietra d'Iſtria.* Among them are great numbers of ſtalactites, of a compact contexture, and of conſiderable bigneſs. They are very common in the

* No, Mr. Ferber! as I have no *national* reaſon, either to ſupport the pretended diminution of the ſea level, or to ſink cities on its behalf, I rather plainly conceive why the ſea-water and its level is conſtantly increaſing upon the land, and unconcernedly agree that really it is ſo in fact. The rivers, diſemboguing into the ſea, continually carry along with them the ſands and clay, which rain, ſnow-water, and torrents, have waſhed down from the higher countries. The ſea conſtantly beats the ſteeper ſhores, and tumbles them down; large rocks and iſlands have diſappeared; others, and very large ones, have been raiſed. The coral-rocks, and ſhell and oyſter-banks, are ever increaſing.——Undoubted facts, whoſe effect on the level of the ſeas and the ocean may be very ſlow, but become ſenſible in the progreſs of time. And ſo it is found, in fact, not only at Venice and in the Adriatic ſea, in many places which have been pointed out by Mr. *Manfredi*, *Zendrini*, *Vitaliano Donati*, and *Alberto Fortis*. (Viaggi di Dalmazia, vol. ii. p. 119.) but likewiſe in the Mediterranean, near *Baja* and *Puzzuolo*, and on the ſhore of Holland; where old Roman buildings, villa's, temples, and fortifications, are covered by the overflowing heightened level of the ſea.

caverns of thoſe calcareous mountains. The cornice of the frontiſpiece at the beautiful new *Jeſuit* church at *Venice*, being built of *Pietra d'Iſtria*, gives a ſtriking evidence of its eaſy diſſolution, by a great many hanging ſtalactites which ſtick to it, and have been, in a few years, produced by the ſoaking and diſtilling rain water. They are forming in the ſame manner in the ſubterraneous caverns of this calcareous ſtone, whoſe grain and mixture ſeems to be very ſubject to diſſolution.

The ſtreets and bridges at *Venice* are paved with black, grey, and red lavas, from the Euganean hills near Padua, in which frequently appear white ſmall polygon ſherl-cryſtals, and black ſmall ſherl-ſcales. The red and yellow Veroneſe-marble is much employed in gate-poſts, tables, chimnies, or other architectonical ornaments.

Before I cloſe this letter, I ſhall juſt mention to you an excellent collection of models, of the beſt ſculptures and ſtatues in Italy *. It is in the palace of Mr. *Farſetti* at *Venice*; and I treſpaſſed on our agreement reſpecting the fine arts, only to make you take due notice of it when you come to *Venice*.

* It is rather a more valuable collection of plaiſters formed over the originals; ſuch as that of the inſtitute at Bologna, given by Pope Lambertini, and another of that kind lately eſtabliſhed by the Elector Palatine at Manheim in Germany.

LET-

LETTER IV.

Venice, Nov. 12, 1771.

I AM now going from Venice to *Bologna*; and I give you by this poſt an abſtract of the different obſervations, which my unwearied worthy friend, Mr. *Giov. Arduini*, during ſo many years, has made on the nature of the Vicentine and Veroneſe-hills, and which he has kindly communicated to me. You will ſee by it how excellent a Mineralogiſt he is, and how great a loſs it would prove to Natural Hiſtory, if he ſhould not digeſt his obſervations into the form of a conveniently extenſive ſyſtematical Treatiſe. What I can write you is but a ſketch of a plan, which he has provided materials to execute at large, and of whoſe excellence I judge, by the ſmall ſamples I had an opportunity to pick up in converſing with him, and in making obſervations afterwards myſelf.

I have mentioned to you already two printed Letters of Mr. *Arduini's* to Mr. *Valiſneri*. In theſe Letters he has divided the *Vicentine* and *Ve-*

roneſe-hills, according to the difference of their beds and their preſumptive antiquity and origin, into *Montes primarios*, *ſecundarios*, and *tertiarios*.

He calls *Montes primarios* the ſlate, which runs under the ſuperincumbent calcareous hills, and which muſt have been anterior to their origin; *Montes ſecundarios*, the large calcareous hills, divided into ſtrata, conſiſting of a compact impalpable limeſtone, and containing petrified marine bodies; ſuch are part of the Alps, or the large chain of mountains that ſeparate Germany from Italy; *Montes tertiarios*, or *colles*, he calls the lower hills, which conſiſt likewiſe of ſmall limeſtone beds filled with petrifactions, or now and then conſiſt of ſand and clay-beds, but are of a later origin, ſince incumbent on the *Montes ſecundarios*, and produced by their decays variouſly waſhed down and accumulated together. Add to theſe the *volcanic hills*, or their remains and old devaſtations. Remember what I ſaid to you in one of my former Letters, that their eruptions came from beneath the ſlate, or from a ſtill greater depth, and that they have broken their way through the *Montes ſecundarios* and *tertiarios*.

And now permit me to entertain you by a particular account of each of theſe four different ſpecies of mountains, which are found in the Vicentine and Veroneſe territories.

I. *Of the inferior Slate, de Montibus primariis.*

This ſlate is of a clayiſh (argillaceous) ſubſtance, commonly containing much micaceous particles, now and then ſilver-coloured; croſſed by Quartz veins; lamellated or ſhivery; often appearing in wave-like bent ſtrata. It is the deepeſt rock in the Vicentine and Veroneſe countries, and has never been dug through; whence it is uncertain whether there be any granite under ground as in other mountainous countries; though this be very probable, ſince the granite rocks appear from under ground in the higher Alps of Tyrol; and the grey granite or granitello is to be found near *Tozzino* and *Primiero*, at the ſpring of the river *Ciſmonoe*, which falls into the *Brenta*. Near *Schio* in the Vicentine territories there are facts to ſupport the ſame opinion; I mean, mountains of porphyry, which are likewiſe very common in *Breſciano* and *Bergamaſco*; but Mr. *Arduini* aſſures me, this laſt is ſuperincumbent on the ſlate and a volcanic production, which I hope to examine myſelf. This ſlate is here, as in other countries, that ſort of rock which commonly contains the metallic veins; but they are here, for the moſt part, under the ſame law, which you, my deareſt friend, have ſo very well obſerved in the *Bannat*; that is to ſay, the veins

are found between the ſlate and the calcareous rocks, where they border upon, and ſkirt or ſeparate, one another. That is the caſe with the large vein of copper-pyrites at *Agorth*, in the *Belluneſe* in *Valle Imperina*, where the Tyrol-ſlate dips under the Venetian Alps. Theſe *Agorth*-mines yield every year large quantities of copper, ſulphur, and vitriol. They ſave in a vitriol-manufactory a good deal of cemented or precipitated copper, by putting iron into the boiling pans. Purſuing the limits and borderings of the ſlate and the limeſtone hills along the chain of the Alps, you will meet, in the ſeparation of the primitive ſlate and the calcareous hills, with different metallic veins and mines. For example, going from the *Valle Imperina* to the weſt, you find within ſix Italian miles of thoſe rock-limits at *Feltrino nella Valle delle Monache*, the mercury and cinnabar mines, which for many years have been worked by the *Magiſtrato delle Miniere*, but now are deſerted. In the ſame valley you meet with old bings and marks of other metallic mines. The chief vein at *Schio* in *Monte Narro* runs between the ſlate, which is its hading ſide *(das Liegende)* and between the limeſtone, which is its hanging ſide *(das Hangende)*. It yields lead-ore, copper-pyrites, black jack *(blende)*, white calamine, mundick or marcaſites, and manganeſe or brown ſtone.

The

The white calamine seems to have been in this vein produced by the solution of blende or black jack in the vitriolic acid of the pyrites, precipitated by lime, which is nearer related to the acid than to the zinc-ockre.

There are likewise at *Schio* some metallic veins in the calcareous hangings or incumbent rocks, which I shall notice afterwards. In the hills near S. *Ulderico*, at *Tretto*, in the Vicentine territory, have been, in former times, very deep silver mines, and there is still to be found heavy rhomboidal tessellated spar, which yields some lead.

Near *Recoaro* are old mines in slate; but Mr. *Arduini* has been more particular on these parts in his Letters to Mr. *Valisneri*. The mineral waters near *Recoaro* spring in a calcareous hill, and form fine incrustations.

2. *Of the calcareous Alps,*
(De Montibus secundariis.)

I have told you already, that they are, for the most part, of a fine compact impalpable grain; that scarce any of them are of a *saline* contexture; that they are formed in strata, containing now and then some marine petrifactions. But their strata are very different, on account of their hardness, grain, composition, lamellated texture, hardness

of their finer particles, colour, fiſſures, cracks, and petrifactions; which are very different in different beds, and conſtantly the ſame in the ſame bed. To have a general idea of theſe beds, from the loweſt parts up to the ſummits of theſe calcareous Alps, I can tell you, that they are generally as follows.

1. The deepeſt lime-ſtratum, from the foot or root to the middle of the Alps, is compoſed of an innumerable quantity of many ſmaller beds, and is at the exterior ſides of the hills waſhed by the deſcending rain or ſnow-waters into a great quantity of perpendicular gutters, which form, as it were, as many pyramidal bunches of a dark lead-colour. This large ſtratum contains but few petrifactions; if any, they are hollow, or conſiſt in the inner ſtony nucleus of the ſhells, or in the petrified inhabitants * of the ſhells, whereof nothing is left but the inner moulding. Theſe nuclei are likewiſe hollow, and filled with cryſtalized lime ſpar; but all theſe marine petrifactions conſiſt in ſmaller *bivalves* and rifled *tellines*.

* The Editor of Mr. Ferber's Letters ought to have blotted this *lapſus judicii*, as certainly he could not be ſeriouſly of an opinion, which is inconſiſtent with the nature of theſe animals; and even with his ſaying immediately after, that theſe nuclei are moſt part hollow and filled only with cryſtalliſed ſpar.

2. The

2. The following ſtratum is a ſmall bed of a compacter, whiter, and leſs cracked limeſtone, fit for gate-poſts and other architectural uſes. This contains, next to the inferior former ſtratum, ſome ſmall unknown *oſtracites*; in its upper parts are no petrifactions at all.

3. The ſtratum which is commonly found in the third place, conſiſts of many ſmall beds, either deſtitute of petrifactions, or containing different ſea-ſhells in different beds. The ſmaller beds in its upper-part, next to the enſuing fourth ſtratum, conſiſt of what they call *Oolithes*.

4. This ſtratum contains many ſmaller ones; and theſe are either of a red colour, containing frequent *ammonites* of an enormous ſize, or entirely white, and then contain no petrifactions or ſcarce *ammonites*. The red *Veroneſe* marble, filled with ammonites, is dug out of this ſtratum.

5. Then follows an infinite variety of white limeſtone beds. Thoſe which are uppermoſt in the higher mountains, for example, *Monte Torraro*, contain nothing; but the reſt is filled with different marine bodies, each ſtratum being filled with a peculiar ſpecies.

6. The uppermoſt covering of theſe Alps is called by the Italians *Scaglia*, and conſiſts of a calcareous bed, which contains either in interſperſed nodules, or in ſmaller beds a great many variouſly

variouſly coloured flints. It caps the Alps on their ſurface, dips under the *Montes tertiarios Bericos*, and riſes again on the other ſide up to the volcanic hills, on whoſe ſloping ſides it is ſuperincumbent, having been by their eruptions firſt raiſed and elevated, and then perrupted or broken. This *Scaglia* does not every where appear on the ſurface of the Alps, being deſtroyed in many places by time and weather, and is found and unaffected only in ſmall holes and vallies. Mr. *Arduini* has found in the Scaglia in *Monte di S. Pancrazio* red flints branching as corals; and in the Scaglia ſuperincumbent on the ſides of volcanic hills near Padua riſe ſulphureous hot wells *(putizze.)*

Theſe ſeveral ſtrata of the Alps have been formed by nature generally in an horizontal poſition; but, having ſuffered many devaſtations by *earthquakes* and *volcanic* eruptions, as ſplitting them into large fiſſures and cracks, through which the lavas forced their way and occaſioned funnels and craters; they have been much diſordered, which makes them appear at preſent ſunk in ſome places, raiſed in others, and brought from their original level to a dipping, oblique, or even vertical poſition. In ſome places they are wholly overturned. *Inundations* and *rivers*, whoſe channels and courſe might be ſuppoſed to have been very often changed by earthquakes, have likewiſe cauſed

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in the Alps and their ſtrata many perruptions and devaſtations; the former appearing at *Agorth* in *Valle Imperina* near the mines, and the latter by what I ſhall relate.

The fields near *Gallio*, *Aſiago*, *Campo di Rovere*, and other places, belonging to the *Sette Communi*, are ſituated in the mountains much above the level of the ſea, and are covered with a great many detached pieces of granite, quartz, and other vein-rocks, which appear to be forced from, and to belong to, the Tyrolian primitive mountains. Theſe ruins appear in the ſame horizontal elevation in ſeveral other places of the Alps, as in *Feltrino (Stato Veneto)* ſeparated by the *Brenta* from the former; weſtward on the ſame Alps from *Aſtico* to the *Adige*-river, and ſo on. Their quantity and variety of ſizes is remarkable at *Tonezza* and near *Folgaria* in the hills under the Auſtrian juriſdiction; which, being entirely calcareous, and entirely deſtitute of ſound, primitive ſtrata, prove the more that theſe forced and blunted rocks, pebbles, and ſands, are adventitious *(geſchiebe.)* This phænomenon is the more ſingular, becauſe theſe ruins are exactly of the ſame kind as thoſe which the *Adige* and *Brenta* waſhes and carries down from the Tyrolian mountains; and the level of theſe rivers being at preſent one thouſand feet lower, it is impoſſible

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to conceive how in their course, so deeply cut into the Alps, they could have rolled and deposited the before-mentioned stones at so superior and high elevations. But this, and similar observations, force us to conclude, that their channels and beds have been, in former times, at the same elevations which are marked at present with what they deposited. No water can have carried, rolled, and forced them up into their actual position, whatever allowance be made for its impulse, and whatever violent inundations we should please to suppose. This stands a fair evidence for the great ruptures of the Alps, and for the prodigious effects of the unwearied and never-ceasing course of rivers; and answers pretty well for still greater ones, which may have been occasioned by violent ruptures and inundations in such places, where earthquakes first stopt, and afterwards entirely changed, the course of rivers.

There is in the calcareous Alps a great number of *natural caverns*, incrustated with stalactites; and besides them some *metallic veins*, which I cannot pass over in silence. They are neither large, nor do they run far into the field; but are smaller metallic fissures, crossing the compact limestone in the largest and undermost stratum. They are lodged in its cracks, constantly next to the sole and to the neighbouring inferior slate and

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its metallic veins, to which they seem to belong as ramifications. The fissures of the solid limestone, which are filled with volcanic materials, do likewise now and then contain metals. This appears at *Schio*, and shall be taken notice of in the description of the volcanos. Commonly there is no ore or vein to be found in the uppermost strata of the calcareous Alps, which are shivery and lamellated. The following break through the undermost compact and sound limestone.

1. The old silver-mines in a heavy spath in *Monte di S. Catharina* in *Tretto*.

2. In *Monte di Trisa*, *Monte Narro*, *Monte di Castello di Pieve*, near *Schio*; and in several other hills towards *Recoaro* to the west, compact limestone mixed with volcanic productions; and some veins and old mines, yielding lead, silver, and copper-ore, in a ponderous spar, with pyrites, manganese, and blend.

3. In *Monte Sivellina*, near *Recoaro*, sound and hard limestone without any visible stratum; and petrifactions and old mines in a lead-vein; and coarse tessellated lime spar, with manganese and amethists.

4. In *Valle di Gorno* in the *Bergamasco*, lead-ore and blende.

3. *Of*

3. *Of Lower Hills,*
(De Montibus tertiariis.)

These are posterior to the *Montes secundarii*, being superincumbent to them either in vallies or on their slopings; partly produced by their decays and accumulated sand and clay-beds. They have likewise regular strata, and different petrifactions; but, in particular, *Nummularios* and *Lenticularios*. They have also suffered many devastations by volcanic eruptions: and our finding inclosed in the lava large fragments of limestone, petrifactions, and other adventitious bodies, is entirely owing to such violent eruptions from under ground, since the fluid lava has surrounded and taken up whatever body was in its way. Often they have been covered with volcanic ashes. Some of these *Montes tertiarii* are posterior to the eruptions, and superincumbent on their productions. If these contain any lumps of lava, pumice-stone, &c. they have been brought into them from afar, and by water. In several places in the Vicentine, Veronese, and other districts of the Venetian dominions, they conaain coal-beds, and have inclosed in them some petrifactions; such as a petrified fish in a coal-slate, which has been found at *Monte-Viale* in the *Vicentine* district.

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There is ſcarce any ore or vein to be found in theſe hills; and, I do not know whether ſome ſandy and argillaceous hills in the *Valle de Signori*, in the *Vicentine* diſtrict, can be ranked among them; as containing coals, plaiſter, alabaſter, ſulphureous pyrites, together with ſome lead, copper, and iron-ore.

Some of theſe hills in the *Vicentine* and *Veroneſe* diſtricts are very famous on account of their numerous and fine petrifactions. Such are the *Montes Berici* near Vicenza, and eſpecially the following.

Creazzo, three miles diſtant from *Vicenza*, furniſhes the inner nuclei or impreſſions of *Chamites*, well-preſerved *Pectinites*, the *Arca Noæ*, the *Chitos Linnei*, and ſome ſcarce *Gloſſopetras*. In the ſands are ſmall fragments of *Madrepores*, ſmall *Nautilites*, and ſome ſcarce fiſh-teeth.

I Colli di Montecchio e Caſtel Gomberto contain plenty of petrifactions.

Brendola, ten miles diſtant from *Vicenza*. The undermoſt ſtratum of this hill is a blue clay, crowded with marine bodies, and covered by an innumerable quantity of limeſtone beds, containing a great variety of ſea-ſhells, but different from thoſe in the clay. The beds are ſomewhat dipping toward the ſea or the eaſt. The weſt-ſide of this hill is covered with lava, and this for the

moſt

moſt part ſtriated and formed like ſherl. A cleft of the lava, called *le Speſſe*, ſhews at the bottom of a ſmall rivulet, which runs in it, an antient ſea-ground, filled with an aſtoniſhing quantity of *Madrepores*, *Fungites*, and a great variety of exotic ſhells. It is pleaſing to ſee ſuch a ſingular mixture of marine and volcanic productions.

At S. *Vido*, two miles diſtant from *Brendola*, is an immenſe quantity of *Oſtracites*.

At *Grancona* near *Brendola*, and on the road next to the villa *Figini*, are frequently found petrified echinites, and eſpecially the *echinus orbiculus* (*Linn. Syſt.* p. 666. n. 17. var. 8. or *Gualtieri Teſtac.* tab. 110. fig. B.) in its natural ſtate inhabiting the Indian ſeas. There is likewiſe *Serpula lumbricalis* (*Linn. Syſt. nat.* p. 787. n. 693.) At one hundred yards diſtant from that place, fine *Nummularii*, and ſome *Balani*, which ſeem to be undeſcribed.

Favorita, an iſolated hill in the Vicentine diſtrict, has been deſcribed by Mr. *Arduini* in the *Giornale d'Italia*, who found there ſome bones and teeth belonging to a crocodile.

In the *Veroneſe* is *Ronca*, a hill ſituated at the *Valle del Buſo*, and piled up as it were by Neptune's and Vulcan's emulations. Their different productions are very diſtinct, but ſpeak confuſion and devaſtation. The ſummit is entirely volcanic, without

without any marks of petrifactions. Somewhat lower you meet with calcareous beds, incloſing petrified *bivalves*, *nummularii*, and *turbinites*; then follows black very hard lava, cracked and broken into ſmall pieces, which have nearly an angulated priſmatical form; afterwards red clay or marle with petrifactions; again lava with pumice-ſtones and breccia, or limeſtones cemented by lava; other limeſtone beds with petrifactions, and ſo on. This hill furniſhes plenty of very handſome and well-preſerved different ſorts of *oſtracites*, *murices*, *anomiæ*, and *bones*. There may be about thirty different ſpecies. *D'Argenville* has mentioned them in particular, p. 175. They are found not only in the calcareous ſtrata, but likewiſe in the lava in the volcanic ſands and aſhes, which, mixed and coagulated with limeſtones, have produced a ſpecies of breccia. There are different ſorts of pumice-ſtones. I have been told, that ſome years ago there was a new eruption of fire and ſmoke, which has deſtroyed and changed a large part of this mountain.

At *S. Giovanni Ilarione*, in the Veroneſe diſtrict, over-againſt the houſe of Mr. *Balzi*, on the other ſide of the river, there is plenty of *lenticularii*.

Bolca is a ſteep and barren hill, at twenty miles diſtance from *Verona*, for the moſt part of ſtratified limeſtone, but now and then interrupted by

ancient volcanic craters. The limeſtone contains variegated flints, of a red, black, green, and white colour. In this hill are found the famous impreſſions of plants and fiſhes: and among theſe deſerve particular notice, a *muræna*, of three palmi Romani, which I ſaw in the cabinet of the apothecary *Bozza*, at *Vicenza*; and another of the ſame kind, kept by Mr. *Seguier*, at *Niſmes*. All around *Bolca* there is nothing but lava, pumice-ſtone, and burnt-ground.

The calcareous ſand-mixed hills near *Recoaro*, and eſpecially *Lo Scoglio della Limpia*, contain a vaſt number of *entrochi*, *gryphites*, *terebratulæ*, *pectoncles*, and *feathers* of *Echini*.

Backwards near *Valdango* is the quarry of the fine *Marmo pavonazzo brecciato di Tungara*.

In the hills near *Leonedo* are fine petrifactions of well-preſerved Adriatic ſhells.

Near *Caſtegnero* lithophytes and ammonites; and near *Cerna*, and the houſe of Mr. *Ceſarini*, petrified lobſters *(granchi e paguri)*; all which places I have taken ſo much notice of, that you may not fail to find them whenever you ſhall go to Italy.

4. *Of*

4. *Of the ancient* VOLCANOS; *their Effects and Productions.*

Their eruptions from under ground of the ſlate, and perhaps from a ſtill greater depth, are evidenced at *Recoaro*; where you may ſee in the ſlate a great number of oblique fiſſures filled with lava. Theſe fiſſures and clefts have been undoubtedly produced by earthquakes, whoſe concuſſions and exploſions have produced ſo many diſorders in the beds of the ſuperior calcareous mountains *(mont. ſecundarii)* and hills *(mont. tert.)* To them is owing the dipping oblique ſituation of ſo many mountain-beds; which moſt part, and originally, had been precipitated by water into an horizontal poſition. Thus the *ſcaglia* and the upper beds of the calcareous hills are obliquely incumbent on the ſides of the Euganean-hills. The lavas have not only filled up the open fiſſures and clefts of the calcareous hills, produced by their drying or earthquakes; but they have likewiſe inſerted and forced themſelves between their ſtrata, which they have ſeparated and lifted up *, as frequently may be ſeen in the *Valle Poliſella* in the Veroneſe diſtrict, and in many other places. Floods and

* The ſame has been diſcovered by Mr. *Whiteburſt*, in Derbyſhire.

inundations have very often by newer ſtratas *(ſtrata tertiaria)* buried and covered all the old volcanic devaſtations; and new eruptions from under ground ſucceeded afterwards. Hence it is obvious, that many ſuch accidents may have happened by turns in the courſe of ſeveral thouſand years; and that the conſequence of them ought to have been, a ſingular mixture and confuſion of marine and volcanic materials. Therefore, we are not to wonder if petrifactions are found in the lava and volcanic aſhes, as has been noticed in ſeveral places before, and eſpecially in the deſcription of *Monte Ronca*. A *coal-bed* may very eaſily have been ſurrounded by the fluid lava; and ſuch a one is in *Monte Viale* in the *Vicentine* diſtrict. Hence too aroſe whole ſtrata of breccie, or mixtures of lava, marble, and limeſtone; which offer themſelves in *Monte Ronca* and the following places.

Lo Spiſſo di Tonneſa, a calcareous rock belonging to the Vicentine Alps, ſhews on one of its ſides a large perpendicular fiſſure, which goes down into the deep torrent *Aſtico*, and is filled with a ſort of marble; which has a great reſemblance to the *Breccia Africana*, but conſiſts of a mixture of white ſaline and fine marble-fragments, cemented with black lava. It takes a fine poliſh.

The ſame *lava brecciata* offers itſelf near that place in *Valle d'Eriofredo*, and more to the weſt towards

towards the *laghi di Posena* under a large rock, called *Il Castello di Tovo*; as likewise, above these *laghi* in the large western vallies, between the Alps of the *Communità d'Arciero*; in the *Montagna di Lovegno* between *S. Rocco* and *S. Ulderico*; and to the West of *S. Catharina* towards *Ena*, where the lava is of a black-green colour. It is very common in the Alps near *Recoaro*.

Open volcanic craters are, in these countries, found in the *Alps (mont. secund.)* and in the hills *(mont. tertiarii.)* There are two, for example, in an hill near the church of *Borgo vicariale di Malo*, in the Vicentine district; another in the Veronese in *Valle Pantena*, on *Monte di sette fongi*, or of *Castello di Marostico*. A remarkable one is in a calcareous hill, called *La Montagna di Lovegno*, in the *Vicentine* district. It is very large and deep, and of an inverted conical form. The bottom is filled with lava, containing a great quantity of shattered primitive slate and quartz; whence its eruption appears to have broken out. On the North it has a large opening, by which the rain and snow-water runs down into the *Torrente di Posena*. The whole country thereabout offers its different lava-torrents and ashes, which cap and cover at present almost every lower hill and plain in the *Tretto*. These lava's are black, and commonly containing a large quantity of white poly-

gone ſherl-cryſtallizations; which, for good reaſons, might be called white *garnets*.

Near this *Montagna di Lovegno*, in the lower hills *di S. Ulderico di Trétto*, wherein, in former times, have been many ſilver mines, they dig that white potters and china-clay, which ſerves for crucibles in the *Murano*-glaſs-manufactories, and is employed in the china-manufactories at *Venice* and *Florence*. The whole country is volcanic; and Mr. *Arduini* is of opinion, that former eruptions of the *Monte di Lovegna* have vomited this clay with much water; and that it is but a fine diſſolution of the inferior deeper ſlate, becauſe it contains many ſhattered ſlate and quartz-pieces, and a good deal of the coarſe glimmer flakes, which are mixed into its ſubſtance. He ranks, likewiſe, among the aqueous or humid volcanic eruptions and their productions, the hard *red bolus*, which is found in a volcanic bed under the *ſcaglia* in *monte di S. Pancrazio*, on the road from *Barbarano* to *Ponte di Moſſano*; and, for the ſame reaſon, all ſuch red, blue, yellow, and cinericious boles, which are found in many volcanic tracts of Vicenza. Theſe boles are extremely fat to the touch; and, if diſſolved in water, they depoſit a fine iron ſand, which is drawn by the load-ſtone, and very common in the volcanic parts of Vicenza; whence, by rain, it is waſhed out, and depoſited in its rills and rivulets.

It

It is a very singular phænomenon, that the Vicentine and Veronese lavas and volcanic ashes contain inclosed several sorts of fire-striking and flint-horn-stones, of a red, black, white, green, and variegated colour, such as jaspers and agates; that hyacinths, crysolites, and *pietre obsidiane*, described by Mr. *Arduini* in the *Giornale d'Italia*, are found at *Leonedo*; and, moreover, that chalcedony, or opal pebbles, and noduli, with inclosed water-drops *(chalcedonii opali enhydri)* are dug out of the volcanic cinericious hills near *Vicenza*. One might consider these flints as being torn and dragged from the scaglia, and thence to have been by floods heaped together with ashes and lavas; because it is a fact, that innumerable quantities of flints, jaspers, and agates, are found in the above-mentioned china and potters clay-hills near *S. Ulderico nel Tretto* (exactly as similar flints are found in the Saxonian and other china clays). But how did they come into those volcanic hills, which, like these at *S. Rocco*, near *S. Ulderico*, never contain any clay whatever? Supposing their having been by subterraneous fire separated from veins pre-existing in or near the very bottom of the ancient volcanos; this explains pretty well how they came into their lava and the china-clay, when in an aqueous dissolution or mixture it was vomited, since fragments of quartz-crystallisations,

marble, and other pre-exiſting ſtones, are likewiſe found in theſe argillaceous beds; but what evidence is there for ſuch ſubterraneous jaſper and agate veins? And for what reaſon are the Vicentine hyacinths, cryſolites, and pietre obſidiane, being true natural vitrifications, never found with the horn-ſtone flints in the china-clay, but conſtantly in the harder lavas? All theſe circumſtances agree in ſupport of Mr. *Arduini's* aſſertion, that the before-mentioned flint horn-ſtones, found among volcanic materials, are owing to ſubterraneous fire and its meltings. Knowing, that by vitreſcent compoſitions and chemical fire even the hardeſt precious ſtones can nearly be imitated, why ſhould we deny the ſame power to Nature and its greater ſubterraneous furnaces *? I do not ſay

* To prevent miſtakes, and the charge of inconſequent writing or reaſoning, the Author ſhould have explained himſelf with more propriety, and with more juſtice to nature, and perhaps to Mr. *Arduini*. Therefore the Tranſlator, who has examined ſeveral volcanos, and ſtudied Nature in her own manufactories or officines, endeavours to ſet him right. His obſervations are ſo far agreeing with Mr. *Ferber's* and *Arduini's*, that he conſiders the chalcedonies as volcanic productions, but in a quite different ſenſe, as that, in which the aſhes and lavas, with their various incloſed ſherl-cryſtallizations, chryſolite, or hyacinth-like vitrifications, and pietre obſidiane, are called ſo. Theſe are undoubtedly *immediate productions* of the fire and violent melting; the former being but *parafitical ſtones of volcanic*

ſay that *all* agates, jaſpers, horn-flints, and finer precious ſtones, have been prepared by volcanic fire,

canic matrices; that is to ſay, but *mediate productions* of the fire, as being viſibly produced by water, either ſoaking through and into the holes of volcanic ſtones, and depoſiting therein the flint-like fire-ſtriking ſediment of chalcedony; or, if properly qualified and heated by natural fire or fermentation, precipitating the ſame under other circumſtances. The former appears to conviction, by the Vicentine and Iceland-chalcedonies; the latter by a ſingular phænomenon, which I ſhall take notice of.

The Vicentine chalcedonies, found in volcanic-tufo, contain now and then incloſed in their middle drops of the water which produced them; and the Iceland-chalcedonies bear likewiſe undoubted marks of an aqueous origin. The Tranſlator knows, by good authority, that they have been diſcovered but of late; and ocular inſpection has convinced him, not only that theſe Iceland-chalcedonies are equal in grain and colour to the Oriental ones, but remarkably ſuperior to them on account of their bigneſs. He had large pieces ſent from Copenhagen above a foot ſquare: and what is more to the ſubject, incloſed in a browniſh tufo, in which they appeared to have been ſtratified or ſucceſſively depoſited by water; conſiſting more or leſs of white or tranſparent beds, about an inch thick, and ſticking as cloſe together as the ſimilar ſtrata of the coloured agathes or onyx. Mr. *Banks's* late voyage to *Iceland* brings us ſtill a ſtep further. He examined there the marvellous intermittent ſpouting hot wells, called the *Geyſer's*, at *Laugafell*, which in the middle of a *ſolfatara* or ancient volcano, by their accumulated ſediments have produced or raiſed a wide ſloping hill of white *lebes* or *pot-ſtone*. I forbear to draw from this ſingular phænomenon the many conſequences which it offers for Natural Hiſtory; obſerving only, what is more to the purpoſe,

fire, since I have a great many evidences of the contrary, and of their aqueous origin by induration,

pose, that in some harder pieces of white lebes, kept in Mr. *Banks's* Iceland collection, there appears a stratified white chalcedony, which cannot be considered as adventitious, and undoubtedly is produced either by a finer sediment, or by its greater saturation; proving, that the substantial earth of chalcedony and lebes are the same, and that both are nearly related to the lapis nephriticus, the serpentine, the bacon-stone, the amianth, and the talc, which are found in many volcanic places; and according to Mr. *Marggraf's* experiments, have been by many Mineralogists wrongly placed among the argillaceous stones.

Similar operations of properly qualified hot wells, so common and various in volcanic countries, might very well answer for the jaspers, agates, and other flints, in the china clays and boles. But whether they have, in fact, produced them, must be left to future proper enquiries in the volcanic countries, where they are so very common.

Jasper is found in large beds and rocks in Sicily, near *Barga*, in the Apennines; at *Montieri* in the *Sanese* (LETTER VII.); near *Franckenberg* and *Cassell* in Hessen *(ibid.)*; in Iceland (Mr. *Banks's* cabinet); and, perhaps, in many other countries equally famous for their being volcanic. Marine bodies uncertain whether ever inclosed in them.

The agates, equally destitute of marine bodies, are very plenty in Sicily: and to the Translator's knowlege, in great varieties of colours, found in some veins or their nodules.

The *common flints* seem, to the Translator, to be rather saturated and glued parts of old marine sediment-beds. He found them either sticking in the calcareous strata of fine grained limestone as produced in them, or in dragged and washed de-

tion, which clearly appears in the ſcaglia of Vicenza; but I ſee the poſſibility, the probability, and the evidences, of either of theſe opinions: and, I preſume, Nature comes at the ſame end by different ways. Perhaps this opinion, if ever ventured to the public, will be more than ſufficient to bring a charge of mineralogical hereſy upon me; eſpecially if I ſhould happen to be judged by people who never have ſeen or examined any volcano, but are the better acquainted with ſtones and mountains produced by

cays of deſtroyed lime, or in chalk-ſtones. In the former ſtate, he ſaw them in the limeſtone quarries near *Goſlar*, (LETTER XIII. in a note) and remembers them to be noticed in Mr. *Abilgaard's* account of the Soeren-Klint in Denmark; in the latter, they are common on our ſhores and in our chalk pits. In whatever ſtate found, they contain a great variety of marine ſhells and productions; ſuch as different echinites and their feathers, ſmall pectinites, and ſmooth bivalves, aſterias columnares and various corals, fungites, madrepores, and retepores. Belemnites are very ſcarce in the flints; ſo too petrified bones and gloſſopetrae. However they are found, cochlites and ammonites the Tranſlator never obſerved in them. Remarkable it is, that the corals, whether fungites or aſtroites, have a ſingular tendency to be changed into common flint. This the Tranſlator obſerved particularly in the uppermoſt limeſtone-bed of the Tonnieſberg, on the road from Hanover to Wetbergen in Germany, which is entirely calcareous, and contains no flints, except a great variety of flintified branchy ſtriated corals, aſtroites, and fungites.

water,

water. This, indeed, is very often the case. We are unhappily too much inclined to draw general conclusions from particular observations, and to flatter ourselves of having exhausted Nature's powers, by judging and explaining its operations according to a single method. Very often we do not even suspect her being able to answer the same purposes by different ways. I have many evidences of it here in Italy; since, by a law of retaliation, and in spite of our ultramontane mineralogists, who, perhaps, may be too fond of the aqueous hypothesis, they explain all by their volcanic system, even unseen Nature, and the fossils of countries which have few or no volcanos at all. Happy the man, who, cautious of extremes, adheres to no hypothesis, and is not in haste himself to believe, but admits of facts, even if they should be opposed to his former ideas!

You certainly remember, my dearest friend, that last summer we saw in Bohemia many basalt-hills, and in such places where we suspected only productions of water-dissolved materials. I fancy, likewise, I have told you my observations of the Habichwald, near Cassel; where, in the agreeable company of my learned friend Mr. *Raspe*, I noticed several marks of ancient volcanos. He has since sent to the English Royal Society a Dissertation; wherein he asserts with a high degree of

proba-

probability, that the Heſſian baſalt-hills have been produced and cryſtalliſed by ſubterraneous fire. Moreover, I can tell you at preſent, that ſome of the Paduan, Vicentine, and Veroneſe lava-hills, are columnar-baſaltes, either entirely or in part; and that Mr. *Deſmarets*, travelling through theſe parts, has been induced by them, to preſent a Diſſertation to the Academy at Paris, and to explain the origin of baſaltes by ſubterraneous fire and its fuſions. This has been oppoſed by that great naturaliſt, Mr. *Guettard*; who, in his treatiſe on baſaltes, aſcribes its origin to an aqueous cryſtalliſation, and cannot conceive how regular or cryſtalliſed bodies can be produced by fuſion. I certainly do not conceive it neither; but I find in the greateſt part of the Vicentine, Veroneſe, and Paduan lavas, an infinite quantity of white polygone ſherl-cryſtalliſations, whoſe figure is as regular, and ſtill more polygon, than the baſaltes; and can be ſuppoſed to have been formed in the lava during its preparation or fluidity, as ſuch innumerable quantities of cryſtallized ſherl, in ſuch a ſhape and figure, have not been, till now, found in any mountain or part of the world; and, for this reaſon, not to mention many other difficulties, it ſeems almoſt improbable to ſuppoſe them, in ſuch aſtoniſhing plenty, pre-exiſting in the bottom of all the Italian volcanos, and thence to

have

have been thrown out. Is there any thing then to anſwer for their origin but fuſion? But I am far from drawing hence a general concluſion, and to deduce the origin of all baſalt-hills from volcanos. It is poſſible, that ſome might have been formed by an aqueous cryſtalliſation: and, I frankly tell you that I was of that opinion, as I ſaw the Saxonian and Bohemian baſaltes. I ſhould like to examine them over again! Certain it is, that the Paduan, the Vicentine, and the Veroneſe baſalt-hills, have been, in former times, parts of volcanos, and that they are compoſed of the ſame lava as their other parts; one ſide of theſe hills commonly being columnar, and the other conſiſting of rude, unformed, lava maſſes. I ſhall mention ſome of theſe baſalt-hills.

Il monte di S. Luca ſopra Maſone nel Maruſticano, joining to the ſouthern deſcent of the hills belonging to the *Sette Communi*, is calcareous at the foot; but at the ſummit volcanic, and covered with columnar baſaltes.

Il monte Roſſo, in the diſtrict of Padua, is entirely columnar *.

Near *Montebello* and *Sorio*, in the Vicentine diſtrict, near *Gambellara*, there is of the ſame kind.

* Deſcribed by *John Strange*, Eſq; in a paper to the Royal Society, which was read 1774, and, with a fine engraving, inſerted in *Philoſ. Tranſact.* vol. LXV. part 1. for 1775.

Il

Il monte di Diavolo, near *S. Giovanni Ilarione*, in the Vicenza *, is a columnar basalt-hill; consisting of black hard prisms, of four, five, six, and seven sides, in an oblique position, their heads pointing to the West, and their feet to the East. The whole mountain, on both sides of the valley of *S. Giovanni Ilarione*, is volcanic, and composed of lava; but a single part, on the East side, is columbar and called *Il Scoglio del Diavolo*. The under part of this hill is calcareous, or an Alpine summit, covered by strata-tertiaria.

In *monte Ronca* is likewise a bed of prismatical lava, which I have mentioned already.

The Piperini, indurated ashes, cemented with micaceous sherl-lamelles, are found around the volcanos; together with hills of loose ferruminated ashes, of a grey or brown colour: for example, at *Braganza*, *Sarcedo*, *Montechio*, *Precalcino*, *Zojano*, and several other places in the Vicentine district.

Most of these volcanos have broken their way through the calcareous Alps or hills; accordingly they are destitute of the regular and usual form of other volcanos; but the Euganean hills near Padua, which rise in the plain between that place and the Alps, have a regular form, being entirely

† Described and engraved in the above account of Mr. *Strange*.

isolate

iſolate and conic. They are ſurrounded with the ſcaglia; which conſiſts of calcareous beds, croſſed by black horn-ſtone veins, and is obliquely ſuperincumbent to their ſides, ſeeming to have covered the whole plain in which they aroſe. This happened by the effuſion of the lava, which through their crater ran down on every ſide, and not only heightened their ſummit, but thickened their periphery to a conical elevation.

I cannot finiſh without taking notice of the minerals, which now and then are found in volcanic countries, and have been occaſioned either by ſublimation and ſteams of the ſubterraneous fire, or by its vomiting the metallic bodies, which it met with under ground and incloſed into the lava.

To ſublimation ought to be aſcribed the *ſulphur*, which in ſome volcanic countries appears in the ſurface of the ſoil; and *vitriol* is owing to ſulphureous acid and iron, as *alum* to its penetrating clay or argillaceous ſtones, and gypſum or ſelenites to its uniting with lime. The *cinnabar*, which appeared in the ſurface of the ſoil at *Silvena nella Contéa di S. Fiore*, had undoubtedly the ſame origin. But, in reſpect to metals, there is no probability of finding any veins in the lavas; nevertheleſs, there are ſometimes in the diſtrict of Vicenza metallic lavas included in limeſtone fiſſures. All lavas contain ſome iron, but in different proportion; and two large rich iron-

iron-veins in *Valle Poliſella* deſerve particular notice, as running in lava.

In *Valle Pantena nel monte di ſette fongi*, in the Veroneſe diſtrict, there is in the lava a vein of a reddiſh-yellow indurated bole, ſtrongly mixt with copperas, which in the field diſappears, and leaves in the vein only ochraceous iron-ore. Next to that place is manganeſe. Lead-ore and blende are found in black lava, which has ſunk into the fiſſures of a calcareous hill *(mont. ſecund.)* in *Valle di Garno*, in *Bergamaſco*; theſe minerals, probably, have been either forced from under ground, or pre-exiſtent in the fiſſures. The ſame may be ſaid of the lead-ore in lava, which has been found in different old and new mines, and volcanic hills, called *le Güizze in territorio di Tretto*, near *Ena*; and in the *Collicelli di Poſena*; and of the lead, copper, and ſilver ore, in pyrites, manganeſe, and blend, which, in compound, volcanic, calcareous hills, and ſeveral old mines, has been found, in former times, near *Leogra*, in the Vicentine territory; at *monte Narro*, *monte Triſa*, *monte del Caſtello di Piere*, and ſeveral other places towards the Weſt, and in *Recoaro*. In the ſame place where they find cinnabar, in Tuſcany, they meet with black, hard, and vitreous lavas, which contain long ſplendid antimony points, that ſeem to have been ſeparated from under ground, and involved in its fluid maſſes.

LETTER VI.

Bologna, Nov. 26, 1771.

I WENT from Venice on the Po, and on canals, by the way of *Chiozza* and *Ferrara*, through a flat, well-cultivated country, which continues a mile beyond *Bologna*, where the Apennines begin. I ſtaid two days at *Chiozza*, and ſaw there a part of the botanic collection of Dr. *Bartolomeo Bottari*, which is well furniſhed with fuci and other Adriatic ſea-plants, whereof ſeveral ſeemed to be new ones. His collection of marine bodies, ſhells, lithophytes, and ſertulariæ, &c. is excellent; as likewiſe his collection of ſeveral microſcopical ſhells, nautilites, and lithophytes, of the neighbouring ſand ſhore. This polite and learned man deſerves a viſit from you. The ſhort ſtay I made in that place was ſufficient to make him my friend. He has written ſeveral Diſſertations on the Natural Hiſtory, or rather the Flora and Fauna, of his country, which are worth printing. You will find him poſſeſſed of a library, not numerous,

numerous, but select; consisting of the best Authors of Italy, and the best Editions of those which concern Natural History, Poetry, and the finer Arts.

I saw too the old Dr. *Vianelli*, who is known by his treatise *de Noctiluca marina*: a worm, which causes the nocturnal lighting of the sea. This lighting is not observed in every season; but besides, as I have been told, is common in the channels near *Chiozza*, in *Venice*, and in the sea near *Naples* *. During

* I have had an opportunity to observe this lighting of the North-sea in the months of July and August, but constantly with South-winds and clear sultry calm weather. During the day we saw many thousands of *Medusæ*, *molluscæ*, and *crabs*, floating near the smooth surface of the sea. Accidentally fishing in a depth of twenty or thirty fathoms, we catched so many of them, that we could not clear the net of their gelatinous substance. Therefore it was hanged to dry in the riggings, and we found the following night it was all on fire. This was owing to the phosphorent nature of these singular animals, and pretty well explained to me the light of the sea; which, in that and several other nights, under the same constitution of the weather, was uncommonly strong. The water at the head, and all along the ship, was in a continual blaze; and in the midst of the broken and skimming billows, I discovered fair shining sparks, that continued so floating for a long while, and appeared so even under the surface of the water. The keel-water seemed to be a fiery smoke rising from under the ship. It traced the course of the ship, and was so luminous, that it spread even a glare of light in the cabin, when candles were put out. Every

During the hotter ſummer months they evaporate ſea-ſalt near *Chiozza*.

The roads to the continent *(terra firma)* ſpread hence to every part, to Padua and Bologna; the road on the ſhore to Rimini, Peſaro, Ancona, Loretta, Spoletto, and Rome, is ſaid to be extremely agreeable, and to run through an excellent, rich, and well-cultivated country.

Count *Franceſco Ginanni*, whoſe collection of natural curioſities has been deſcribed and publiſhed at *Lucca*, 1762, 4*to*. lives at *Ravenna*.

At *Rimini* lives Dr. *Gio Antonio Batarra*, and Dr. *Jano Bianco*. The former has written a treatiſe *De Fungis agri Ariminenſis*, Faenza, 1775, 4to. and prints at Rome a new edition of all the works of *Bonanni*, illuſtrated by notes of his own. The latter has got a reputation by his edition of *Fabii Columnæ Ecphraſis* and *Phytobazanos*; and by his performance *de Conchis minus notis*; wherein he deſcribes ſeveral microſcopical ſhells of the ſand ſhore near Rimini.

At *Peſaro* lives the learned Mr. *Paſſeri*, who is ſaid to have a fine collection of foſſils and minerals, and has written ſeveral inſtructing Letters on

broken and ſkimming billow blazed and ſparkled likewiſe. But Northern winds and high running ſeas made the Meduſæ diſappear during the day, and the nocturnal blazing of the water to ceaſe during the night.

the Peſareſe foſſils, which are inſerted in different parts of the *Raccolta d'opuſcoli Scientifici e Filologici*, printed at Venice by *Simone Occhi*. I did not go by this road, as I went by water to Bologna.

I have not much to ſay to you of the Univerſity. The public halls are many; the library is numerous; and the anatomical theatre handſome, and decorated with fine ſculpture. The botanical garden has been of late aggrandized and much embelliſhed. The Profeſſors have, in the beginning of their academical function, but a ſmall revenue of about forty ſcudi; but it is annually increaſing. They repair at their fixed hours to the public leſſon-rooms, expecting their ſtudents, who ſeldom appear there. But the private leſſons in their houſes are better frequented.

The *Inſtitutum Bononienſe* is a noble eſtabliſhment, and with much magnificence and conveniencies planned out to teach every ſcience. It has been by ſo many travellers, and in a ſeparate volume, ſo well deſcribed, that I have nothing to add.

The Muſcular Preparations in whole ſkeletons are a capital ornament of the *anatomical room*.

In the *Midwifery-collection* I obſerved a great many *Uteri*, made of leather, and in them the fœtus in every poſſible poſition.

The Inſtruments for Experimental Philoſophy are exquiſite. A lady, Signora *Laura Baſſi*, is Profeſſor of this ſcience, and member of the learned ſociety or the academy.

The Chemical Laboratory is indifferent.

The Collection of Natural Curioſities is one of the moſt famous in Europe, and deſerves notice, on account of its former collectors, *Aldrovandi*, *Coſpi*, and *Marſigli*. The collection is general, and contains many fine and ſcarce pieces in every part of Natural Hiſtory; but a good deal of many more impaired by duſt and age. It would bear a vaſt augmentation; nevertheleſs, it is very valuable, ſince it contains part of the natural curioſities deſcribed by *Aldrovandi*; the whole collection of *Coſpi*, deſcribed in *Muſeo Coſpiano Bologna*, 1677, *fol.* and the cabinets of Count *Marſigli*, deſcribed in his noble works on the Danube, on *Corals*, and others. The *Aldrovandi* family is ſtill at Bologna. The *Mineral* collection is poor indeed; however, I ſaw in it ſeveral curioſities from the country about Bologna; which are the following:

1. Impreſſions of leaves, and other parts of plants, in grey-coloured, lamellated gyps, which is throughout penetrated by native ſulphur, from the plaiſter and ſulphur-works in the Popiſh dominions, in *Peſareſe in territorio Forolivienſi*, which have

have been described by Count *Vincenzo Mafini* in his poem *Il Zolfo*, in three books, printed a second time at *Bologna*, 1762, in 4*to*. The above plaister is employed in mouldings in the china-manufactory at Venice.

2. *Ludus Helmontii*, or cubical marl-stone, ferruminated by calcareous spar-veins, from *rio delle maraviglie presso al Martignone sul Bolognese*.

3. Several petrified shells from the Bolognese. The smaller, and most remarkable ones, have been described by Mr. *Bassi*, in the *Acta Instituti Bononiensis*.

4. The celebrated *Lapis Bononiensis*, a selenitical spar; which, after a convenient ustulation, grows phosphorescent, and has been, together with other phosphorescent stones, very well described by Mr. *Markgraf* at Berlin. The waiter of the Institute makes, of this stone and Tragacanth, stars, and other such things, which light in the dark. He sells them pretty high to travellers, who believe him, on his word, to be the only man possessed of this arcanum. The *Lapis Bononiensis* is found in pieces of a white opaque, or semi-pellucid water-colour, either entirely solid or in nodules, striated from the centre. It is found detached and loose *in monte Paterno*, three Italian miles distant from Bologna, in clay or marl, whence it is washed by rain.

5. Yellowish sand-stone, hereabout called *Macigno*, commonly used at Bologna in foundations and columns. The softer sort is unfit for architecture, as dissolving in the air. This is very common in the hills near the Apennines, on the road to Florence. The harder and better species is dug at *Pontixano*, thirty miles distant from Bologna; a somewhat softer near *Piancio*, fourteen miles distant; and the softest near the city-wall in *villa Barbiana ad Scottas*.

6. *Gesso Scajola*, or *Scagliola*, or *Lapis Specularis*, is common in the clay-hills about Bologna. The purer ones are burnt to plaister, and the coarser serve in masonry.

7. Red *Sal Gemmæ* from Catalonia.

The library of the Institute possesses a valuable treasure, in the manuscripts of *Aldrovandi* and *Marsigli*. A great part of the latter deserve publishing. *Aldrovandi's* hand-writing is in such small letters, and pestered with so many abbreviations, that it is very difficult to read it.

The collection of the late celebrated apothecary *Zannoni*, at Bologna, now in the possession of his nephew, contained a great number of petrifactions, shells, amphibies in spirit of wine, and a large herbary. Several of his scarcer plants have been described and engraved, under the title, *Stirpes Zannoni cum Annotationibus Montii*.

Among

Among the petrifactions, I took notice of the *Concha polyginglyma, testa crassa foliacea, margaritacei coloris, cardinibus paralleliter multo-fulcatis*, which is found in the hills about Bologna, in Switzerland, and in several parts of Germany. I remarked likewise several *turbinites* changed into agates with distant spirings. They had some resemblance to the Wendel-trap; and many Bolognese petrifactions have been described by Mr. *Bassi*, in *Commentariis Bononiensibus*.

Mr. *Ferdinando Bassi*, member of the learned society, and keeper of the botanic garden, is very learned in botany, and other parts of Natural History. The *Bassia* honours his name. He has published several Dissertations in the Bolognese Transactions; a treatise, *Ambrosina novum plantæ genus*; and another under the title of, *Analisi delle terme Porretane Roma*, 1768, *4to.* His minerals and shells are considerable; and his collection of the portraits of the most famous Naturalists, drawn in black, is very valuable. Pity it is, that his health has been lately much impaired by apoplectical injuries.

Mr. *Cajetano Monti*, Professor of Natural History at the University and Institute, and member of the Learned Society, is a very learned man. He has parts and fire. The *Zannonian Stirpes*

have

have been explained and publiſhed by him; and he has printed an excellent Speech, occaſioned by the doctoral inauguration of Mr. *Caſimiro Gomez Ortoga*, a Spaniard. *Bologna*, 1764, 8*vo*. His father, *Giuſeppe Monti*, was likewiſe a good Naturaliſt; and publiſhed *Prodromum Floræ Bononienſis*.

Abate Gabriello Brunelli is the denominated ſucceſſor of Mr. *Monti*, and his aſſiſtant in the inſpection of the botanical garden, and of the cabinets in the Inſtitute. He is a learned man, who, perhaps, may favour the public with a deſcription of this collection.

A lady, *Signora Anna Morandi, vedova Mazolini*, imitates anatomical preparations in wax, which ſtand the compariſon with thoſe of that famous lady at Paris.

The late celebrated Profeſſor *Giacomo Bartolomeo Beccari* is dead long ſince; but his memory lives in ſeveral of his performances, eſpecially in that *de Phoſphoris*. There have been ever ſince in Bologna very learned men, in every ſcience; and theſe may be known, by an excellent book, which will appear ſoon in a new improved edition; the title is, *Notizie delli Scrittori Bologneſi raccolte da Orlandi*. Bologna, 1714, 4to. A ſimilar account of every Univerſity would be an excellent improvement of literary hiſtory.

Mr.

Mr. *Teſſari*, who has publiſhed *Linnæi materiam medicam omnium trium regnorum cum Annotationibus*, and *Elementa Chymica*, is Profeſſor at Bologna.

The Mineral-collection of a Barnabite, Padre *Marcello Cortinovis*, is kept in the *Seminario de Barnabiti*; meanwhile, its poſſeſſor, animated by his taſte for Natural Hiſtory, has undertaken a voyage to Calicut, under the character of a miſſionary.

In my next, I ſhall write to you from the other ſide of the Apennines.

LET-

LETTER VII.

Florence, Dec. 11, 1771.

AT a diſtance of one or two Italian miles, on this ſide of *Bologna*, the road continually aſcended over the Bologneſe-ſand, marl, and lime-ſtone-hills; and thence to the Apennines, which are ſtratified, grey, and hard limeſtome, with petrifactions. Their higheſt top is at *Pietra mala*. Thence we deſcended to a place called *le Maſchere*, ſome Italian miles diſtant from Florence, where we left theſe mountains, and came to the agreeable hills of Tuſcany. The pleaſing green of alternating cypreſſes, firs *(pinus picea ſylveſtris & abies)*, larch *(pinus laryx)*, walnut, and olive-trees, the fertility of the grape, and of the olives, which in this ſeaſon ſpread an oily ſmell, was certainly very refreſhing to the eyes, tired by the uniform grey colour of the naked Apennines. Now I ſhould communicate to you my mineralogical obſervations of this journey; but ſeveral circumſtances have eſcaped my attention, and I ſhall travel

travel this part over again, if I ſhould not happen to meet with Mr. *Guetard*, and to hear by him what I wanted to ſee myſelf. He is ſaid to be, at preſent, at *Rome* or *Naples*. In either of theſe caſes, I will diſcharge my duty.

To-day I write to you what I have ſeen at *Florence*; but the rainy ſeaſon puts many ſtops to my curioſity, and has brought me to the reſolution to ſet out in a few days for Rome, and thence, after a ſhort ſtay, for *Naples*. I know that in that place there will be much buſineſs for me; that the climate is the ſofteſt in Italy; and that I can ſpend there the bad ſeaſon, with leſs inconvenience for me, thence to return in a better ſeaſon to *Rome*, *Siena*, and *Florence*; which giving me opportunity to paſs twice through the ſame country, will make my obſervations the more perfect, and the more acceptable to you. But now let us ſpeak of *Florence*. This noble place was ever a ſeat of the uſeful and finer arts; and the Florentines have, for ſeveral centuries, enjoyed the well-deſerved reputation, of being a witty, elegant, and clean people. The mountainous, airy, and charming ſituation of this country; the good taſte, the encouragements, and the wiſe ordinances, of a good government; a general opulency, in compariſon of the other Italian provinces; and the greater chearfulneſs and contentment of the inhabitants, have certainly their

ſhare

ſhare in this reputation, and in the great number of valuable performances which they have publiſhed in almoſt every part of literature. The excellent Diſſertations of the Academy *del Cimento* and *della Cruſca* are univerſally known; and why ſhould I name to you ſo many private men, which have diſtinguiſhed themſelves in every part of the ſciences, and of good taſte? The flouriſhing ſociety for the improvement of huſbandry, and another, which is entirely planned for botany, deſerve great eſteem. Not to ſpeak of Florence in particular, there are well-ordinated Univerſities at *Piſa* and *Sienna*; in that city a celebrated ſociety of the ſciences, and a botanical one at *Cortona*. This certainly ſeems ſufficient for a country whoſe circumference is not very large; but the generous public ſpirit of its preſent Sovereign, and his own acquaintance with the Muſes, will give to his reſidence a new ſplendour, by the eſtabliſhment of a new Academy, calculated for every practical uſeful ſcience, which will the better anſwer his purpoſe, as there is no ſparing of expences. The palace *Torrigiano* has been bought for the Academy, and is changing now into halls, and cabinets of books, natural curioſities, phyſical inſtruments, anatomical preparations, and other requiſites. A botanical garden, a chemical laboratory, and an aſtronomical obſervatory, are building.

Some rooms are preparing for the Grand Duke himſelf, and for his entertainment in the ſciences. Profeſſors in every part of practical knowledge are engaged; and the direction of the whole is at preſent, and will be for the future, intruſted to the Abate *Felice Fontana*, late Profeſſor of the Mathematics at Piſa, and now Mathematician to the Grand Duke. He has given to the public ſeveral works, which are valuable proofs of his parts *. I have ſeen a part of the microſcopical diſcoveries, which he has deſcribed in his writings. The old phyſical inſtruments, which in former times belonged to the *Academia del Cimento*, have been tranſported hither from the gallery, and a great many new ones are ordered at Florence, or bought at London. The foundation of a library is laid by the phyſical and mathematical books of

* 1. Dei moti de l'Iride. Lucca, 8vo.

2. De legibus irritabilitatis nunc primum ſancitis. Lucca, 8vo. inſerted by Baron Haller into his treatiſe *ſur l'Irritabilité & Senſibilité*.

3. Ricerche Fiſiche ſopra il Veleno della Vipera con alcune oſſervazzione ſopra le anguillette del grano Sperone. Lucca, 1767, 8vo.

4. Nuove Oſſervazzione ſopra i globetti roſſi del Sangue. Lucca, 1766, 8vo.

5. In the *Giornale dli Firenze Giugno*, 1771. is a Proſpectus of a new work on the diſtempers of corn, called Ergot and Volpe, and on the Vinegar worms.

the

the *Libreria Magliabechi*; and a young man, born at *Florence*, working under Mr. *Fontana's* direction, imitates in wax his anatomical preparations of the human body, in a higher degree of perfection than I saw them any where before. He mixes white wax with several sorts of white gums, to prevent its melting and cracking. All is coloured after nature, and then properly varnished. Some parts of the head, the eye, the ears, and the tongue, are already fixed on wooden tables, and highly and properly finished for illusion. The future collection of natural curiosities is to consist of,

1. The cabinet of Rumphius.
2. Van Sproeckel; and
3. The curiosities, which before have been kept in the gallery.

In the last are large pieces of fossil calcined ivory, dug out near the *Lago di Trasimene*, or *di Perugia*.

The second belonged to Van *Sproeckel*, a druggist at *Leghorn*; and was, when he died, bought by the Grand Duke for two thousand pezze Toscane. It consists of minerals, petrifactions, corals, marine plants, zoophytes, shells, earths, and a materia medica. A stone belonging to this collection is, according to a ticket fixed to it, given out for a petrified spunge, found at *Luciana* in Tuscany. The form, the appearance, and the

colour,

colour were exactly those of a ſpunge, but its weight made me incline to think it a pumice-ſtone. However, I leave it to your judgement, if you come here and ſee it. *Bertrand*, in his *Dictionary of Foſſils*, ſpeaks of petrified ſpunges.

The collection of *Rumphius*, the very ſame which he deſcribed in his Amboiniſh rarities, was bought by the Grand Duke Coſmo III. from Rumphius, and from Amboina brought to Leghorn. A deſcription of the Amboina animals and fiſhes, with many figures, and written by Rumphius, was bought at the ſame time, but ſent by another ſhip; it periſhed at ſea. This cabinet has been in former times very rich in exquiſite ſcarce ſhells, corals, rich gold mines, precious ſtones, and the like; but it has been much impaired while it was kept in the gallery at *Florence*: Firſt, becauſe Baron *Baillou*, and the phyſician of the Court, Mr. *Gualtieri*, had the conſent of the Grad Duke, to take the duplicates for themſelves: Secondly, becauſe ſome precious pieces, for example the large *Wendel-treppe* of *Rumphius*, in purſuance of an order of the late Emperor have been taken to Vienna: And finally, becauſe the laſt inſpector, a Frenchman, has, as they told me, reaped a good harveſt for himſelf, by his own authority. Among the red corals I obſerved a handſome and branchy one, on which no place

could be diſtinguiſhed whereby it might have been fixed to the ground. There is a parcel of roots and gums, and ſome artificial curioſities; as a ſmall boullet, made of thin braſs, hollow within, containing ſeveral others of the ſame kind, one incloſed in the other, which by the leaſt ſhaking ſuffers a ſtrong and laſting tremulous vibration. The Indian women are ſaid to uſe them as *implements of ſafety*. The *Gummi elaſticum*, according to Mr. *Mocquer's* experiments diſſoluble in æther, is ſaid to be ſubſervient to a like voluptuous abuſe, and eſpecially ſo at S. Domingo.

There are at *Florence* ſeveral private collections of natural curioſities; but the chief of all, and perhaps in all Italy, is that of minerals and foſſils, which belongs to Dr. *Giov. Targioni Tozzetti*, and gives the compleateſt explication of the phyſical Geography of Tuſcany and other parts of Italy. He is a celebrated phyſician, and keeper of the Magliabechi library; and in his natural philoſophy an excellent diſciple of *Micheli*, whoſe collections and manuſcripts he has acquired and conſiderably augmented. Mr. *Tozzetti* has publiſhed ſeveral works *; but eſpecially *Viaggi per*

* 1. Petri Ant. Micheli Catalogus plantarum horti Cæſarei Florentini cum Præf. D. Giov. Targ. Tozzetti, fol.

2. Prodromo della Corografia e Topografia Fiſica della Toſcana, 1754. 8vo.

3. Viaggi

per la Toscana; by which he has much illustrated the Natural History of his country.

I saw in his cabinet all the rocks, stones, earths, marbles, petrifactions, ores, and lavas of Tuscany, which he has described in his journey. I noticed in particular the following.

a. *Chalcedony*, from *Maremma di Volterra* in Tuscany, is said to be found there in beds and strata, and to be dug out from the *Cava di S. A. Reale*, between *Monte Russoli* and *Canneto*.

b. Red sanguine *jasper* with white veins, from *Barga* in the *Apennines*, is found in large beds, and composing large rocky hills †. There are in

3. Viaggi per la Toscana. Ediz. 1. Volumi sei, 8vo.

4. Relazione d'alcuni viaggi fatti in diverse parti della Toscana. Ed. 2. 8vo. Firenze, Vol. I, II, 1768. III. 1769. IV. 1770. A bankruptcy of the bookseller stopt the impression.

5. Halimurgia e delle piante che servono di nudrimento in tempo di caritia.

6. Analisi e difesa della celebre opera intitolata, Alimurgia Venezia, 1769.

7. Ragionamenti sull'agricoltura Toscana. Lucca, 1759, 8vo.

8. Istruzzione circa le varie maniere d'accrescere il pane con l'uso d'alcune sostanze vegetabili. Pisa, 1767, 8vo.

† The same species of red jasper is found in large beds and rocks near Franckenberg in Hessen, whereof large raw and polished specimens are to be seen in the Landgrave's public collections at Cassel. The keeper of this cabinet, whose eminent taste and knowledge appears in its singular distribution, calls it Franckenberg-agate; but he is wrong in that.

the *Capella di S. Lorenzo* at Florence, large polished tables and incrustations of this jasper. And at *Montieri in the Sanese* somewhat above the castle, in *Montagna di Montieri*, which is micaceous slate, and wherein have been old silver, copper, and lead mines, is likewise a bed of red coarse *jasper*, at least three fathoms large, which continues to *Castello di Gerfalco*; but being lamellated and cracked by many fissures, this jasper is unfit for use.

c. Fallow copper-ore with grey striated antimony in quartz, and calcareous spar, found some years ago in Tuscany. The antimony appeared in fibres, which, for some part, were extremely fine, and like feathers.

d. Fine native copper in calcareous spar, or perhaps zeolith, with brown terraceous copper-ore, much resembling the native copper, which in a similar brown earth and zeolith is found in *Ferroe*. This vein was some years ago discovered in Tuscany; but breaking soon off they dropt the mine. Generally the Tuscan veins are but superficial ones *(Wasen laufer)*, never dipping deep under ground.

e. Some petrifactions in flint or horn-stone. Mr. *Targioni* had, in the collection of the celebrated Micheli, a *belemnite* in a jasper; but left this rare piece to *Alexander Funck*, a Swede, travelling some years ago in Italy.

f. Per-

f. Perfect regular parallelopipeda of white ſheri, more or leſs calcined, of the length and the proportionate thickneſs of a finger, incloſed in black lava, belonging formerly to the collection of *Micheli*, who neglected to take notice of the place whence it was brought. This lava reſembled the *Serpentino antico*, but it was large ſpotted.

g. A phoſphoreſcent ſelenitical ſpar, ſimilar to the Bologneſe, common in Tuſcany in detached fragments, in the fractured clay and limeſtone beds, which are called *Galleſtri*.

h. Selenite in tranſparent rhomboidical-cryſtals from ſeveral places in Tuſcany.

i. Argillaceous nodules, by exſiccation or drying cracked in ſeveral places, from *Val d'Arno ſopra Firenze*. Some of them half flint or hornſtone, and covered by a white terraceous ſurface. There are likewiſe in the Val d'Arno ſeveral geodes and other *luſus naturæ*.

k. White argillaceous alum-ſtones, ſimilar to thoſe from *Tolfa*, from ſeveral places in Tuſcany. *See Tozzetti's Travels.*

l. Gabbro, or ſerpentine-ſtone, with white ſpots, from *Cecina nella maremma Volterrana*, where it is found ſtratified; the ſame white, black, red, or green, with incloſed aſbeſtus, from *Prato*; black with mica, from *Monte ferrato di Prato*, has often white calcareous ſpar-veins, and is called by the

common people *Nero di Prato*; frequently employed for ornaments in churches and palaces. The green is called *Verde di Prato*.

m. Several handsome tables of the celebrated *Marmo Fiorentino*, found at *Rimacio* near *S. Cecina*, two Italian miles distant from Florence, and elsewhere. It offers itself but in small beds in the compact limestone, which is commonly of a grey colour, frequently dendritical, yielding a good lime, and called *Albereſe*, or *Albazzano*. This Florentine marble, representing ruins, is likewise known under the name of *marmo paëſino*, as the dendritical under that of *Alberino*. I saw afterwards

2. Several ores, stones, fossils, lavas, &c. from other provinces in Italy and foreign countries. The Sicilian agates remarkably excellent.

3. A collection of natural and petrified shells, zoophytes, and corals; especially from the Adriatic and Mediterranean sea.

4. Seeds, fruits, roots, of exotical plants.

5. A rich Herbary gathered by himself.

6. *Micheli's* Herbary.

7. A choice collection of books made by himself, or left by *Micheli*.

8. The manuscripts of *Micheli*, and other celebrated Italian and Tuscan authors. Several of them have been noticed by Mr. *Tozzetti* in his *Coro-*

Corografia Toſcana; but thoſe of *Riccius* are quite unknown, and never printed. I hope that Mr. *Tozzetti* will publiſh ſome of *Micheli's* manuſcripts; eſpecially the continuation of his botanical work, which contains the fucos, zoophyta, and corals. Above one hundred and fifty plates have been already engraved, at the expence of the bookſeller, Mr. *Bouchard*, at Rome.

9. Some ſkeletons, and bones, teeth, &c. from elephants, dug out in Tuſcany. The teeth are, by the action of the air, calcined.

10. A great number of manuſcripts of Mr. *Targioni Tozzetti*, concerning the Natural Hiſtory of Tuſcany, worth printing. I notice, above the reſt, his almoſt finiſhed Mineralogy of Tuſcany; containing the deſcription, denomination, ſituation, and uſe, of the earths, clays, quarries, mines. The catalogue too of his Mineral-collection is very inſtructing.

11. The Herbary of the celebrated *Cluſius*, given by Prince Eugene to the preſent poſſeſſor.

To underſtand Mr. *Targioni Tozzetti's* travels, and other Italian Mineralogiſts, it is convenient to be acquainted with ſome denominations of ſtones; which either are uſed by the common people, or derived from the Greek. The Italians, having but a ſmall number of mines, have but a few tech-

nical words of Minery, and I give you the greateſt part in the following ſmall Gloſſary.

1. *Albereſe* is a compact commonly grey coloured limeſtone, yielding good lime. If blue coloured, it goes often under the name of *Pietra columbina* or *turchina*. In the *Saneſe* diſtrict they call this limeſtone *Albazzano*.

2. *Albereſe coltellino* is a lamellated limeſtone, whoſe ſurface ſeems to be traced with angulated and croſſed lines, as cut or carved with a knife.

3. *Afroſelino*; a ſtriated, farinaceous looſe gypſum, ſimilar to what they call *chaulks* in *Derbyſhire*. I ſaw ſuch a ſtone ſticking to white piſolithes in Mr. *Tozzetti's* collection, from the alum-works in *Monte Rotondo* in Tuſcany. *Bardelloni*. See *Paleſti* and *Pietra forte*.

4. *Breccie verrucane*; Breccia, ſimilar to a ſpecies which is found in *Monte Verrucola* near *Piſa*. A looſe pebble-breccia, or pudding-ſtone, is often called *Eumecide*.

5. *Calamita bianca*; a white hardened bolus, ſtriated like aſbeſtus.

6. *Cavare a forza de Scarpelli*, break with bills and hammers.

7. *Conicolo e galleria*, a drain.

8. *Cave*. See *Sterri*.

9. *Cicerchina*; a calcareous breccia or pudding-ſtone, conſiſting in a great number of calcareous

ſpar

ſpar grains, ſome quartz flakes, rolled and blunted fragments of lava, glued by lime; found near *Fieſole*, ſerves to poliſh marble. *Ciottoli.* See *Ghiarra.*

10. *Eumeces*, or *Eumecide*, is employed in different ſenſes: Firſt, ſignifying globular coarſe chalcedony-like half indurated clay, which may, perhaps, be a mixture of ſoap-ſtone, found in the *Galeſtro*-hills, related to *Igiada:* Secondly, a coarſe pebble-breccia, or looſe pudding-ſtone: Thirdly, an indurated terraceous ſubſtance, ſtriated and ſimilar to what they call erzmutter, or ore matrix, in Hungary. I had no opportunity to examine whether it be a calcareous or a ſelenitical ſubſtance.

11. *Filone*; ſynonymous to *rilegatura* and *vena metallica*, commonly a bed, ſtratum, or flat-work; but now and then indiſtinctly a metallic vein.

12. *Gabbro*; ſerpentine-ſtone, found in Italy, in Tuſcany, and the diſtrict of Genoa, in large beds and hills, which commonly on one ſide border on calcareous, and on the other ſide on ſlate-hills. See *Polzevera.*

13. *Galactites*; white bacon-ſtone, or ſmectites —the green is called *Pietra nefritica.*

14. *Galeſtri*; ſmall calcareous beds, found between the ſtrata of compact limeſtone, mouldering by the leaſt touch to pieces. Synonymous to *lardelloni.*

delloni. The argillaceous beds in the pietra forte and ſerena go under the ſame names if mouldering. See *Saſſi matti*.

15. *Ghiarra*; ſmall detached ſtones or blunted flint, quartz, limeſtone. Larger ones are called *Ciottoli* and *Ciottoloni*.

16. *Granitone*; a ſtone, conſiſting of a greeniſh ſilver-glimmer, and white vitreſcent ſpar or feld-ſpath, found in large beds in the Gabbro. Sprinkled by ſmall ſpots and fragments into the *Gabbro*, they call it *Granito*, *Grappi*. See *Piombo*.

17. *Igiada*; is a hardened lapis nephriticus or hip-ſtone, or a green horn-ſtone *(petroſilex viridis)*, whoſe origin from green ſmectites or ſoap-ſtone appears plainly in ſeveral of theſe ſtones in my poſſeſſion, which on one ſide are hardened and ſtrike fire, and on the other are ſo ſoft as to be cut with a knife. Sometimes this green ſmectites in the firſt degree of induration takes the form of aſbeſtus; or, it is a true aſbeſt and amianth, as in the Serpentine quarries at *Zoeblitz* in Saxony and as in ſeveral pieces from *Impruneta* in the Florentine territory, or from *Prato*, which I ſaw in Mr. *Targioni's* collection. On my return from Rome and Naples I ſhall not neglect to examine theſe places. The pretended *Proſius (Wall. Min.* 120, n. 3.) from *Breitenbaum*, at *Johan-Georgenſtadt*, and from *Eibenſtock* in Saxony, ſeems to have had a ſimilar

origin. The *Eibenſtock*-ſpecies appears ſtriated as a coarſe amianth.

18. *Inolitho*; ſtriated gypſum.

19. *Iridi*; ſmall quartz-cryſtals of a black colour, with pyramidal points on both ſides. See *Mercati Metallotheca Vaticana.*

20. *Lavatojo*; a waſh-work.

21. *Licafro*; Wolfram.

22. *Litheoſphoro*; phoſphoreſcent Bologneſe gyps-ſtone.

23. *La Machina*; the water-engines, for drawing ore and pumping water.

24. *Macigno*; a micaceous ſtone, conſiſting of clay and ſome lime; appearing rather to be entirely compoſed of glimmer. In the uppermoſt ſtrata it is ſhivery, but very compact and hard in a greater depth. Hence Petrarch's and other poets *petti di macigno* of their unyielding cruel fair-ones. The colour and hardneſs is different. There is

a. Pietra bigia; grey yellow coloured by iron ocher, reſiſts the air, ſerves for columns and walls.

b. Pietra ſerena, columbina & turchina; blue-grey, porous, likewiſe ſerving for columns. They are but varieties of the ſame ſort of ſtone, and often united in the ſame work. Near Siena they call *macigno pietra di torre. Marſe.* See *Piombo.*

25. *Nefritica pietra*; a green bacon-ſtone or ſmectites.

26. *Pietra*

26. *Pietra bigia.* See macigno.

27. —— *forte*; an argillaceous lime or marble-ſtone, found in the garden at *Boboli*, near *S. Franceſco di Paola*, *alla Campora*, near *Florence*, and at *S. Margarita a Montici*, ſerving for the pavings of the ſtreets at *Florence*; blue or yellow-coloured; and therefore diſtinguiſhed too by the names of *pietra bigia* and *turchina*. The ſmaller clay beds in the quarries of Pietra forte are called *bardelloni*.

28. *Pietra morta*; the uppermoſt, looſe, and fractured bed of ſand-ſtone or macigno, unfit for uſe; to be diſtinguiſhed from *Saſſo morto* or ſlate, which goes under that name becauſe it very often is hid and as it were buried by ſuperincumbent limeſtone.

29. *Pietra nefritica.* See *nefritica.*

30. —— *ſerena.* See *macigno.*

31. —— *talchina*; every ſort of micaceous ſtone.

32. *Piſtare*; pound and pulverize.

33. *Piombo oſia argento quà e là ſparſo a'maſſe, a grappi, a grappetti oſia rognoni*; lead or ſilver ore ſprinkled in nodules or grapes into the veins. If it be ſprinkled in ſmaller flakes, they call it *à ſpruzzi*; and if theſe be ſtraying and appearing but now and then, they call them *picciole ſcintille di Piombo*, &c.

34. *Pozzo*;

34. *Pozzo*; a ſhaft.

35. *Polzevera*; a Gabbro or Serpentine, with limeſtone, marble, or calcareous ſpar-veins, or the *Ophites* of Cronſtedt (*Miner.* § 261.) found in large beds in the Gabbro-hills. *La valle di Polzevera*, in the Genoeſe, is called ſo on account of the fine red, black, and green, white-veined polzevera-quarries.

36. *Rilegatura*; a fiſſure filled with quartz or ſpar, or a metallic vein.

37. *Rognoni*. See *Piombo*.

38. *Saſſi matti*; Galeſtri mouldering in ſmall bits.

39. *Saſſo morto*. See *Pietra morta*.

40. *Scagliola*; white tranſparent ſelenites.

41. *Scintille*; metallic flakes. See *Piombo*.

42. *A Spruzzi*. See *Piombo*.

43. *Sterri d'antiche Cave*; the rubbiſh of old mines or bings.

44. *Talchine pietre*; every glimmer or micaceous ſtone.

45. *Variolarie*; blunted and detached ſtones; eſpecially *Gabbro*, whoſe ſurface is knotty.

They have ſerved in former times as ſuperſtitious amulets to children againſt the ſmall-pox; and accordingly they are ſtill at preſent kept by ſeveral Italian apothecaries.

I have

I have hitherto entertained you with the collections of Mr. *Giov. Targioni Tozzetti.* But there is at *Florence* another able phyſician, called *Michel Angelo Targioni*, living *alla piazza di S. Maria novella*, which is not at all related to the former. I ſaw in his houſe an excellent collection of ſhells, belonging to his ſon Dr. *Giov. Luigi Targioni.* He poſſeſſes beſides this ſome minerals, petrifactions, and ſtuffed birds. He has ſome exotic and rather unknown drugs. This gives me an opportunity to tell you, that the *Fungus Melitenſis* or *Sanguinaria*, which is deſcribed in *Linneus's Amœnit. academicis*, is to be had in the Florentine apothecaries. I had been told that it grows near Leghorn; but that happened only once by accident, in a place where ſome earth and ſeeds from Maltha had been accidentally thrown. Mr. *Giov. Luigi Targioni* has publiſhed a treatiſe *de attractione & gravitate.*

Dr. *Saverio Ferdinando Moretti* is profeſſor of botany in the botanic garden, and ſecretary to the ſociety of huſbandry; and Dr. *Antonio Durazzini* is ſecretary to the *Academia botanica*; which ſocieties each ſeparately aſſemble in the above-mentioned garden in a ſmall room, wherein is kept a collection of ſeeds. The garden is large and well ſituated, planted and claſſified according to the two chief ſyſtems, that of Tournefort, adopted by Mr. *Manetti*, and that of *Linneus*; but there

is

is not at present the same plenty of plants as of late, when Mr. *Manetti* published *Viridarium Florentinum, seu conspectum plantarum, quæ floruerunt & semina dederunt.* Florent. 1751, cum Appendice, 1752.

The celebrated *Petri Antonii Micheli Catalogus plantarum horti Cæsari Florentini, cum Præf.* D. Joh. Targioni Tozzetti, indicates a still greater plenty of this garden, which suffers at present by want of a convenient fund.

Mr. *Manetti* is author and publisher of *Storia naturale degli luccelli*, with coloured prints; whose first volume appeared at Florence, 1767, *fol.* The figures are drawn after living birds kept in the Grand Duke's menagery *al Giardino di Boboli*, near the palace Pitti, or after stuffed ones in the fine collections of Senator *Gerini* and Mr. *Mivni*; or copied from books. He is likewise author of a good periodical paper, under the title of, *Magazino Toscano*, which contains many useful objects relating to physic and husbandry. Another paper of that kind is properly designed for Diætetics, or objects relating to he preservation of the human body. A third Florentine paper is called *Giornale di Firence.* The *Novelle Letterarie di Firence* have ceased with the life of the learned Mr. *Lami.*

I saw

I saw in the Grand Duke's gallery, the grinding and polishing of the ancient Greek marbles, and the modern harder stones *(pietre dure)* such as agates and jaspers. Samples for cabinets and fine tables of the Florentine marble may be had from the journeymen, and at a good rate too, though they ask enormous prices of the unexperienced stranger. They make here excellent mosaic-works, called *Interseccatura*, or *Lavoro di commesso*; which consists of figures of animals, flowers, and other high-coloured objects, cut from coloured stones, ferruminated by a composition of white wax and pitch, and polished afterwards either into flat tables or into bas reliefs. It is hard work, requiring much time, and accordingly very dear, especially figures in relief.

In the *Capella di San Lorenzo*, are not only ornaments of this *Lavoro d'Interseccatura*; but likewise of the finest marbles, jaspers, and agates, in large pieces, and composed in the noblest taste. The keeper of this majestic chapel sells a small printed account of the different antique and modern stones employed in it. Even the *Arno* and other Florentine rivers furnish some species of fine horn-stones and jaspers, which are ground in the gallery. I reserve for another time an opportunity of speaking to you of the fine green and violet spotted Corsican marble; of the violet granite,

nite, from *Iſola d'Elba*, the Marmo Polveroſo di Piſtoja, and other ſpecies of that kind.

In the church *di S. Spirito* are many columns of the before-mentioned *pietra ſerena*; which is a variety of macigno, and the chief altar is made of *Gabbro* and *Polzevera di Prato*, green and black, or red and black white ſpotted.

In the convent of the Dominicans at *S. Marco*, and in the hoſpital *di S. Maria nuova*, they make excellent diſtilled vegetable oils and eſſences; which, together with cedrates and confected fruits, are in great quantities exported from Leghorn to the Northern countries. But more of the Florentine curioſities at my return from Naples and Rome.

LETTER VIII.

Rome, Dec. 26, 1771.

I Cannot ſpeak but with rapture of this old noble city, where I arrived a fortnight ago. In that ſhort time I have ſeen ſo many majeſtic beauties of the fine arts, that my memory can ſcarce hold them. That infinite number of churches, decorated with a profuſion of the fineſt taſte: and of palaces, whoſe noble ſimplicity forces even the ignorant to ſenſibility; that innumerable hoſt of life-breathing ſtatues and pictures; the many villas and gardens, which each ſeparately would be conſidered in every other reſidence as royal ornaments; and the great many caſcades and jet d'eaux, which are ſo many rivers falling from or riſing to the ſkies, muſt needs raviſh and charm every ſtranger. I am ſtill ſo much under the charm, that I would give myſelf the pleaſure of telling you whatever I have ſeen here. But I know that all theſe excellent works have been

been described in many books, that by them they are known to you, and that my descriptions would not afford you the least part of the delight which they will force upon you if seen by yourself. Therefore I will be true to Natural History, and go on, under the conduct of this generally neglected or unnoticed guide, to admire Roman art. If Art be Nature's daughter, both will, I hope, very well agree together. I have already observed several sorts of antique granite, basaltes, porphyry, and marbles, in the treasures of the capitol, the villa Albani, the villas, and the churches. I have visited some of the marble- and stone-cutters; and, though they are Jews in their trade, I have bought many fine samples. But I spare their description till my return, when I shall have seen and examined, at leisure, more churches and collections. Then you are sure of some good supplements to the Lithography of the Ancients, in which you have penned already down so many fine observations. *Rome* is, indeed, on this account, the best place for a Mineralogist. They cannot dig here in the adjacent vineyards through the rubbish and ruins of ancient palaces, which to the heighth of fifteen feet cover the pavings of old Rome, (see Madame *Du Bocage's Lettres sur l'Italie*) without meeting with rich provisions of the finest antique marbles, porphyry, and basaltes, which

the proprietors of the ground ſell by the pound. Even the ſtreets are in many places, and eſpecially before St. Peter's church, paved with ſepentino antico, porphyry, and antique marbles. So are the floors of the churches and palaces. I will now ſpeak to you only of the *pietra elaſtica*, in the palace *Borgheſe*. It conſiſts of ſeveral ſlabs or tables of a white antique marble, which are ſaid to have been cut from a cornice-block belonging to an old building. Theſe tables are about four palmi Romani in length, one palm in breadth, and two inches thick. One of theſe pieces is deſigned to be ſhewn to ſtrangers; the others are ſet up as ſide-boards. This table, being put with the larger end on the ground and ſhaking it, gives on both ſides an alternating belly, but ſprings by an elaſtic motion and with a cracking ſound into its former form. It is a white antique marble, affected by aqua fortis, and compoſed, as appearing under the microſcope, of tranſparent cryſtalline grains. Its flexibility is undoubtedly owing to an imperfect connection of its grains. This was loſt, perhaps, by the action of the air, or by a ſoft calcination of fire, which deſtroyed a part of its natural cement: ſo that, the plate being bent, theſe particles are forced to roll or ſhift, which produces the crackling ſound. Its friability, which is ſuch that even the nail of a finger makes

makes it appear, countenances the ſame opinion. It has been already ſpoken of and deſcribed by the learned *P. Jacquier delli Minimi alla Trinità di monte* in a periodical paper, and by *P. Fortis* in his *Saggi ſopra l'Iſola di Cherſo ed Oſero.*

The ſtone and marble cutters at Rome imitate, in marble, fruit, eggs, and ſuch things, which are to be had *al Corſo.* They give, by maceration and coloured acids, to the white marble, a red, yellow, blue, and green colour, which penetrates and ſoaks pretty deep into its ſubſtance.

In the ſame ſtreet are ſold imitations of cameo's, cut in thick ſea-ſhells. The ground is commonly blue or reddiſh; the relievo white. Fine impreſſions in red ſulphur ſell for five bajocchi apiece.

The old Moſaic-works, imitating Nature by a compoſition of ſquare ſtones, are done at Rome in a high degree of perfection; they at preſent commonly employ only artificial ones, which for the moſt part are manufactured at Venice, in a variety of about a thouſand colours. Theſe *fritta's* or artificial ſtones are firſt cut with a diamond, and then with a convenient iron hammer broken into cubes; which, according to their bigneſs and colour, are ſeparated in different cheſts and drawers, and kept for uſe. The fixing and compoſing them

is the ſame as in the before-mentioned Florentine Moſaic work. I have ſeen a Moſaic portrait of the preſent Emperor, which was highly reſembling him; and a great many artiſts are employed to decorate St. Peter's with ſuch immortal undecaying pictures. They have improved the art of the ancients, and attempted coloured baſſo relievi.

In the villa Adriani at *Tivoli*, near *Fraſcati*, and in other places, have been found the nobleſt ancient monuments of that kind. I obſerved in them blue frittas, which proved to me that the ancients knew the uſe of cobalt and the preparation of ſmalt *. The fineſt red fritta, reſembling ſealing wax, is but a copper-ſcoria, whoſe compoſition was an arcanum of a certain Mr. *Matthioli* at Rome. Though they imitate it, they do not arrive to the ſame brightneſs of colour.

The cabinet which *Mercati* deſcribed in the *Metallotheca Vaticana* has diſappeared.

The *Muſeum Kircherianum*, in the *Collegio Romano* under the direction of the Jeſuits, has been

* They had it, perhaps, as many other mechanical arts, from the Egyptians. At leaſt the Egyptians employed ſmalt or vitrified cobalt in their paintings and pottery, as plainly appears on the painted Mummy-cheſts, and in ſeveral ſmall earthen figures, kept in the Britiſh Muſeum.

deſcribed

described by *Bonanni*. It contains a fine set of precious stones. There is preparing a new edition of that book, under the title of, *Bonanni rerum naturalium Historia*; which will appear with Annotations of Mr. *J. A. Batarra*, in two volumes in folio.

LETTER IX.

Naples, Jan. 13, 1772.

THE few weeks which I have been in this school of the volcanos have not been sufficient to give me full and compleat ideas of Vesuvius, Solfatara, and other such curiosities of this country. I want to have them improved, enlarged, confirmed, or refuted, by new and repeated observations. I shall therefore defer my own observations, and give you an account of those ingenious persons with whom I am already become acquainted.

First, then, I tell you, that I had the singular pleasure to meet here with Mr. *Guettard*, from Paris; an excellent Naturalist, and an old acquaintance of mine at Paris. We are much together; and, what is flattering to me, I see our observations are, for the most part, corresponding.

Mr. *Serrao*, physician of the court of Naples, is a man of great knowledge, not only in physic but

but in Natural Hiſtory too, as appears in his treatiſes on Veſuvius, the Tarantiſmus, the Hiſtory of the Lion, the Elephant, the Boar, and in ſundry others.

Dr. *Giuſeppe Vairo*, profeſſor of chemiſtry and phyſic, is an excellent chemiſt, a very polite obliging man; and, perhaps, the only Naturaliſt at Naples, who is ſcientifically acquainted with Veſuvius and Solfatara. He favoured me with his company to that place, to ſhew and to explain to me its chief curioſities. I got in his houſe an acquaintance with a young phyſician, Mr. *Nicolo Andria*, who is no ſtranger to chemiſtry and Natural Hiſtory. I hope they both will unite to publiſh their obſervations on Veſuvius and Solfatara, either in a ſeparate work, or in the ſupplements of the Leghorn-edition of the French Encyclopedy.

Dr. *Dominico Cirillo*, profeſſor of botany and phyſic, a ſon of a celebrated phyſician, has travelled in France, England, Dalmatia, and Sicily, and by that means gathered an excellent Herbary. He is poſſeſſed of the late *Ferrantis Imperati* collection of plants, and had once a thought of a Neapolitan Flora; but phyſical practice has now ſo much engroſſed his time, that I fear he has given it up. He has publiſhed an abſtract of *Linnæi Philoſophia Botanica* for his lectures, under the title

title of, *Dom. Cirilli ad Botanicas inſtitutiones introductio*, Ed. 2. Napoli, 1771, 4to.

P. Maeſtro Antonio Minaſi, a Dominican prieſt, is a good naturaliſt, and an unwearied obſerver. Pity it is, that his ſituation, and the oppreſſing ignorance of his ſuperiors, put him under ſo many difficulties, and almoſt under an impoſſibility, to illuſtrate the Natural Hiſtory of Calabria. Being born there, and beſides that a clergyman, he could ſafely travel over a country, in which any other obſerver would make but a ſhort way. He has made many curious obſervations upon ſeveral ſorts of ſpiders, upon the currents in the Mediterranean, the Faro at Meſſina, and the Scylla and Charybdis; and he has produced paper, linen, and other manufactures, by the fibres of the pulpous leaves of the *Agave Americana*. His are the greater part of the Remarks on the Natural Hiſtory of *Tarento*, which are inſerted in the Marquis *Carducci's* tranſlation of the *Delizie Tarentine, opera poſtuma di Tommaſo Nicolo d'Aquino*. Napoli, 1771, 4to.

Abbate *Nicola Pacifico* is a good mathematician, and learned in the ſcience of inſects and plants. Beſides ſome collections of that kind, he keeps *all' infreſcata*, where he lives, a ſmall botanical garden. This is the only garden of that nature at Naples,

Naples, since that of Count *Chiaramonte alla barra*, near Portici, has been in decay; and Prince *Francavilla* has ceased to keep exotical plants.

The Marquis Abbate *Gagliani* is known by some agreeable and interesting performances on politics and commerce, which he published at Paris. But I take notice of him on account of his knowledge in the Natural History of Vesuvius. The best Map of the kingdom of Naples has been, by his orders, engraved at Paris. It consists of four plates, which in the royal library at Naples are sold for fourteen carlini. To his advice it is owing, that the excavations at Pompeja are not filled up like those at Herculaneum; and that the descriptions and engravings of the Herculanese Antiquities may be had at present in the royal library.

Padre *Giammaria della Torre*, professor of natural philosophy, has given several editions of his Description of Vesuvius. The last is a French one, under the title of, *Histoire et Phenomenes du Vesuve, exposés per le Pere della Torre.* Naples, 1771, 8vo. He has published besides, *Nuove osservazioni intorno la storia naturale.* Nap. 1763, 8vo. answered by Abbate *Fontana* at *Florence.* He pretends to have found by his microscopical lenticular glasses, melted into that form by a candle, that the globules in the blood are annular and perforated;

perforated; but Mr. *Fontana* proves, that his microscopes, though magnifying the objects greatly, have produced an optical illusion. Moreover, he has published a system of Natural Philosophy, in eight volumes in octavo, wherein he has inserted an history of the three natural kingdoms. It is a good book in itself, and valuable on account of many good figures of animals.

Abate *Getano Bottis* possesses a rich and exquisite collection of all the productions of Vesuvius, and its different modern eruptions. He has given two treatises on Vesuvius, under the titles of, *Ragionamento istorico intorno a' nuovi Vulcani comparsi nella fine del anno* 1760. Napoli, 1761, 4to. And *Ragionamento del incendio del Vesuvio accaduto nel mese d'Ottobre* 1767. Napoli, 1768, 4to.

Mr. *Rocco Bovi*, professor at Salerno, a native of Tarento, is author of, *Dissertazione Italiana e Francese sopra la produzione de Coralli e riflessioni critiche sopra i Polypi, creduti costruttori de medesimi Coralli.* Firenze, 1769, 8vo. He looks upon Polypes not as animal flowers, but as accidental inhabitants of corals *.

Mr. *Luigi Giraldi*, antiquarian of the King of Denmark, lives in the island *Capri*, and has a thought of publishing its Antiquities and Natural Curiosities.

* Mr. *Baster* in *horis subsecivis* supports the same opinion.

Don

Don *Paulo Moccia, Profeſſore delle Scienze umaniore nella pageria reale*, a corpulent man, is naturally endowed with the quality to ſwim, and not to ſink in water.

Padre *Antonio Piaggio* unrolls and copies at Portici the old burnt manuſcripts dug out in Herculaneum. He has a young Abbé for an aſſiſtant; but his age, the nature of the buſineſs, and his ſmall reward, give no hopes that he will unfold a great many of theſe precious remains. He is ſaid to be poſſeſſed of the arcanum to take away the colours from ſeveral ſorts of precious ſtones *, and to give ſimilar colours to common quartz-cryſtalliſations.

Domenico Cottunio, profeſſor of anatomy at Naples, has publiſhed three anatomical diſſertations. One treats *de auditu*, wherein he ſpeaks of a new-diſcovered hole in the ears; which, to the honour of the firſt obſerver, is called *Ductus Cottunianus*. Another, *De ſede variolarum*, does likewiſe much honour to his name.

After theſe gentlemen, I will mention to you ſome perſons who deal in natural curioſities.

Pietro Shilling, living *alla porta piccola di S. Giuſeppe maggiore*, deals in dried fiſhes, lobſters, craw-fiſhes, ſhells, and corals, of the Golfo di

* Burning and uſtulating is a common practice for the ſame purpoſe.

Napoli,

Napoli, and from Sicily. By order of the Engliſh Miniſter, Sir *William Hamilton*, he has procured for the Britiſh Muſeum, at London, a compleat collection of all the fiſhes of the adjacent ſea; which, before they are ſent to England, he has cauſed to be finely drawn. Lately he has received from America a ſingular and unknown fiſh, which Mr. *Guettard* has drawn, and intends to deſcribe.

Il marinaro Paſcali a S. Lucia alla Chiaja, is a fiſher, who ſells the before-named fiſhes, and has good plenty of them.

Michele Pacileo is the beſt Cicerone at Pozzuolo, a good-natured man, well acquainted with the Antiquities of that place, which he explains by many paſſages of Virgil and other ancient authors, and intends to deſcribe in a performance of his compoſition. He aſſiſts, likewiſe, in the collection of the Solfatara curioſities, and deſerves the more encouragement as he is very poor. But beware of another Cicerone in that place, who chatters ſome French and Engliſh, and is a thorough impoſtor.

Don *Valenciani*, at Portici, has a fine cabinet of all ſorts of lavas and productions, in large and fine pieces. At *Naples*, near the palace of the French Miniſter, lives another lava-ſeller, who is a Frenchman. A marble-cutter, living near Portici, at the left hand of the entrance in that place; and

and another at *Naples*, living over-againſt the gate of *Caſtello dell' Ovo*, make marble-tables, with interſeccatures of different ſorts of lava, which they ſell likewiſe rough or poliſhed. They are to be had too of the Veſuvian guides, living at Portici; but you are to be cautious of all theſe people: Firſt, not to pay the exorbitant prices which they aſk you; and then, not to buy artificial glaſſes inſtead of Veſuvian gems or precious ſtones, under which name they ſell the different Veſuvian coloured ſherl-ſpecies.

The kingdom of Naples is provided with many fine ſorts of marble; and theſe have been employed at *Caſerta*, *Capo di monte*, and other places. They may be had, together with ſome antique marbles, in ſmall poliſhed ſamples at Naples. A marble-cutter at *Capo di monte* has made my collection.

Some years ago, the King engaged ſome ſtone-cutters from the gallery at *Florence*, in order to employ them on the Sicilian agates and jaſpers; but, being too few in number, they cannot do any conſiderable work.

The late Prince *S. Severo* has left in his palace at Naples a great many artificial curioſities, moſt part invented by his ſkill in chemiſtry. He has known, for example, how to dye, and thoroughly to penetrate, large white Carrareſe marble columns

with any factitious colour; to change the blue colour of lapis Lazuli into white, and some other such artificial manipulations, as described in a pamphlet on his inventions; and as noticed by Mr. *La Lande* in his travels to Italy. They relate, that he imitated the oriental granite; and accordingly was of opinion, that the Egyptian obelisks, and other such large granite-monuments, have been artificial compositions; but, if he had seen our red-granite rocks in Sweden, or read Pococke's Description of the East, he certainly would not have doubted of the existence of so large natural granite-masses.

LET-

LETTER X.

Naples, Feb. 2, 1772.

I AM but juſt returned from a walk, which three times in a week I take with Mr. *Guettard*, and which is ſo charming, that to have it more ſo, there wants but your company. We go from the *Chiaja* to the right along the ſea-ſhore to Pauſilippo, and return the ſame way. After continual rains from the end of December to the middle of January, we have now the moſt agreeable ſpring; but a ſpring, which nearly reſembles the ſummer of our Northern countries, except the ſeas being continually ſtorming and ſo dangerous, that even the fiſhers do not venture out, and we have almoſt given up all thoughts of going to the iſlands *Iſchia*, *Capri*, and *Precita*. Such voyages are not to be undertaken but in ſummer, when the ſea is ſaid to be conſtantly calm and quiet. But we enjoy the more the pleaſant views of the Continent. The hills of *Pauſilippo* are covered already with flouriſhing almond-trees. Some

flouriſhing palm-trees, the great American Agave (which are growing in the open fields even ſo far North as Rome), fig-trees very common all over Italy, cactus opuntia, the flouriſhing roſmarin, the ever-green lemon and orange-trees, give to theſe hills the moſt agreeable variety of colours, and a reſemblance to a botanical garden *.

The circular form of the ſhore on both ſides of the *Chiaja*; that is to ſay, to the left towards *Portici*, *Torre dell' annonziata*, *Torre del Greco*, *Caſtel mare*, *Sorrento*, *Salerno*, and *Peſto*; and to the right towards the *Pauſilippo*, beyond the *Scuola di Virgilio* to Cape *Miſeno*, together with the theatrical elevation of the hills all around the ſhore, produce the moſt magnificent natural amphitheatre. From every ſpot of this elevated circumference you have a ſight of the whole, of the ſea, of the iſlands *Procita*, *Niſita*, *Capri*, *Iſchia*, and of the Apennines running to Calabria. What a noble view! Ah might I be doomed to enjoy thee longer! Going by the *Grotta di Pozzuolo* to that

* Lemons, citrons, cedrates, pomerances, and china-apples, grow between Rome and Naples every where without any particular culture. There are whole foreſts of ſuch trees near Terracina. But they are in flavour and fragrance much below the Spaniſh and Portugueze fruits. There are ripe wood-berries, and woodberry-ſorbets or jellies, to be had in January.

place,

place, you have on both ſides of the road a country either tilled for agriculture, or planted rows of high Italian poplars, on which you ſee the cluſtering grape. Near *Pozzuolo*, where the road goes nearer to the ſhore, you ſee on the broken lava-cliffs of the old *Solfatara volcano*, to the right hand, a plenty of the *paſſerina hirſuta Linnæi*. Whatever is planted for uſe grows in this country, as appears in the lower and fertile fields to the left, on the road to *Portici*; and the cauſes of this uncommon fertility are evidently owing to the ſoft climate, and to a ſoil fertiliſed by the ſomewhat alkaline Veſuvian aſhes, or the dung of the populous city.

Pity it is, that we are ſo unacquainted with the plants and the natural hiſtory of a kingdom, which is ſo remarkable for its climate and its fertility in ſcarce and uſeful plants. *Calabria* produces cotton, manna, ſilk, corn, oil, the fineſt wines, fruits, and fragrant eſſential oils; which, at a cheap rate, in large quantities, are exported from *Rheggio*, by Engliſh, Dutch, French, and other ſhips. They have too *Sal Gemmæ*, and might have rich ſilver, copper, and iron mines, as in former times ſome have been begun, but dropt ſoon after, a few excepted; becauſe the proprietors of the ground chooſe rather to miſs any advantage, than to give ſome ſmall acknow-

ledgement to the King; for which reaſon, they would conſider any examination of their mountains as incroaching treaſon, and accordingly put a ſtop to the curioſity, if not to the life, of adventurous mineralogiſts. There is beſides much unſafety on account of robbers, and much incommodity on account of the public houſes; which generally makes this country unfrequented by foreigners, and cauſes even the natives to go by water from *Naples* to *Rheggio*.

It is the ſame with *Sicily*, an excellent country, cultivating palm trees and ſugar. A few fine cities on the ſea-ſhore; as, *Meſſina*, *Catania*, *Palermo*, *Drapani*, and *Girgenti*, excepted, ſcarce any ſtranger has ſeen the inner parts of the country *. *Mongibello* or *Ætna* is, on account of its nature and

* However, *audaces fortuna juvat*, and ſeveral foreigners have of late, under convenient eaſy cautions, penetrated into theſe inner parts; whoſe romantic, claſſic, and unknown ground, certainly invites the bold undertaking genius of Britiſh Antiquaries and Naturaliſts. If the pretended robberies and hardſhips of the Eaſt did put no ſtop to our *Pococke's*, *Wood's*, *Stuart's*, and *Chandler's*; and the horrors of an unknown ocean could not abate the undaunted ſpirit of our navigators, and the curioſity of our *Banks's* and *Solander's*; if ſo many hardſhips generouſly undergone by Britons have proved ſucceſsful for the ſciences, and glorious to the nation; why do not we then take proper notice of Sicily and Calabria? Why do not we then reap the laurels and knowledge left for

and foſſils, almoſt entirely unknown. What we know of it, is ſome notices, taken on a voyage to Sicily by Sir *William Hamilton*, the Britiſh Miniſter at Naples; which, if I recollect, are inſerted to the French Encyclopedic Journal, and juſtly prove, that Ætna, in compariſon to Veſuvius, is a giant; but for the reſt, produces the ſame ſorts of lava. The celebrated *Jo. Alphonſi Borelli's Hiſtoria et Meteorologia incendii Ætnæi, Anni* 1669, printed at *Reggio*, 1670, 4to. is extremely ſcarce. I bought here, in a bookſeller's ſhop, an engraved Plan of Ætna, under the title of, *Carta Oryctographica di Mongibello per la ſua ſtoria naturale ſcritta da Giuſeppe Recupero Canonico della Collegiata di Catania*; but the Natural Hiſtory it is deſigned for has not appeared, and perhaps never will appear. The author bears the character of a very learned ingenious man; and it is a pity, that many good undertakings miſcarry, or are ſuppreſſed, by ſuperſtition, and falſe religious fanaticiſm. The old legend of Empedocles's throwing himſelf in the funnel of Ætna is generally known. Mr. *Byars*, an Engliſh Antiquary at

for Antiquaries and Naturaliſts in theſe European Auſtralian countries? *D'Orville*, a Dutchman; Baron *Riedeſel*, a German; and Sir *William Hamilton* and *Brydone*, Britons, have made promiſing ſucceſsful attempts. They dared, and difficulties diſappeared.

Rome, who has been in Sicily, has assured me, that there are on the top of Ætna ruins of a square mausoleum, erected by the family of Empedocles, built from lava, and ornamented with Greek marble; hence he concluded, that this mountain, since about sixteen hundred years, has not changed either its heighth or its form. But Mr. *Honel*, a member of the French Academy at Rome, who has drawn Ætna after nature, has assured me, that there are no such ruins to be found. This mountain must be of an enormous elevation, since from its top a great part of Italy, of the Mediterranean, Sicily, Sardinia, and Corsica, can be surveyed in clear weather. Unhappily I shall not enjoy this noble sight!

Here arrive in every spring a quantity of passage birds from Africa; among others, a large number of quails is catched living, but they are poisonous at their arrival, and probably so on account of their African food; therefore, they are fed during about a week's time with corn, and then dressed and eaten with safety.

The Italian scorpions are very small in comparison to the African ones.

I saw yesterday a large *Asterias caput Medusæ*, which had on its under part, near its middle opening, sticking, a smaller medusa. The fisherman *Pascali* said it was a young medusa still cling-

ing to the mother. There may be ſome truth in that. Theſe meduſas and ſeveral white and red corals, which ſell at Naples, are catched on the coaſts of Sardinia, and thence brought hither.

The *pinnæ marinæ*, yielding a brown ſilk or byſſus, which is manufactured into gloves, purſes, and ſuch milliners goods, are fiſhed in the Golfo, near Naples; but in ſmaller quantities on the Calabrian ſhore.

The *pietra fongaja* is a white calcareous and ſtalactite tuph-ſtone, dug in the lime-ſtone-hills bordering Romagna, and endowed with the quality to produce in every ſeaſon of the year eſculent muſhrooms, if kept in a moiſt cellar, and now and then ſprinkled with water. This quality is owing to a great many roots and vegetable fibres, together with the muſhroom-ſeeds incloſed in its ſubſtance. They uſe them in ſome great houſes at Naples and Rome. I ſaw an indurated mould, from the ſame place, which had the ſame quality. It was kept by Mr. *Fabrini* in the mint at Florence.

I have ſeen, a ſecond time, the Herculaneſe and Pompejan antiquities at *Portici*. It is in every reſpect an excellent inſtructive collection. The *lacrymatoria* prove the ſkill of the ancients, to produce a fine, white glaſs.

At Naples, and thereabout, they feed their horses with the roots of *Triticum repens Linnæi*; a food which they delight in, and which is commonly to be had in the markets in large quantities.

LET-

LETTER XI.

Naples, Feb. 17, 1772.

TO have my ſhare of the laſt week of the Roman carnaval, I am obliged to ſhorten my ſtay at *Naples*. Had I the happineſs to be entirely independent, I ſhould ſtay here ſome months more, and make a trip to Sicily. But I ſhall in a few days return to Rome.

You are entitled to an account of Veſuvius, Solfatara, and other volcanic curioſities; and to-day I will diſcharge this debt.

The hiſtory of the different eruptions of Veſuvius, and the operations at Solfatara, are pretty well related, and, with ſome curious obſervations, leading to a phyſical knowledge, publiſhed in the different deſcriptions which have been quoted by *P. la Torre*, in the French edition of his book. But a true, pure, and ſyſtematical Natural Hiſtory of theſe Volcanos is ſtill to be expected, ſince the greater part of theſe authors have been deſtitute of mineralogical and minery-ſcience. A peruſal

usal of these books will easily prove it to you. I will not detract from their character. I will rather slip over the particulars in which they may be depended upon. But they contain many gross errors, especially on account of the mineralogical denominations, and of Natural History, which are entirely inconsistent with Nature, and mislead the reader. For example, *P. la Torre* entirely mistakes Nature, when, speaking of the white polygone, or garnet-like sherl-crystallisations in the lava, he calls them *marcasites*; moreover, observing with much danger to his life the inner structure of Vesuvius, when that mountain was burning, and pretending to have seen in its funnel as it were *timber* and *poles*, from whose exterior appearance he draws a conclusion upon the original rocks of the mountain, which, however, he does not determine: I certainly do not wrong him, asserting, that his pains and his danger have been good for nothing. Such have been too, and will ever be, the pains of those, who, for instruction's sake, climb the mountain over and over again, especially when it is burning. They never will meet with any thing but lava and volcanic ashes, which cap Vesuvius all around and cover the whole country about Naples. I have been but twice at the top. Once I ventured into its funnel, which, in some depth, is covered by a lava floor;

floor; or, as Miners would call it, a lava-roof *(bühne)*; but the danger to be suffocated, as well as to sink with that precarious roof down to bottomless perdition, did not procure me a sight of any thing but of sulphur, smoke, and fire, which issue from its fissures. Therefore, to get as nearly as possible acquainted with the inner nature of Vesuvius, I see no means but a mineralogical examination of the adjacent country and its volcanical productions; this will bring us to probable conclusions bordering on certainty: and these will do, as long it will be impossible to sink shafts into the undermost Vesuvian rocks, and thence to fetch samples to convince stubborn incredulity. "*Naturæ vis atque majestas in omnibus momentis fide caret, si quis modo partes ejus ac non totam complectatur animo.*" Plin. N. H. lib. vii. c. 1.

The country about Naples, the ground on which the city is situated, the *Pausilippo*, *Pozzuolo*, as far as Cape *Miseno* and further, the neighbourhood of *Portici*, of *Vesuvius*, and beyond *Pompeja*: in a word, every hill and plain which incloses the Golfo at the *Chiaja* and the city, is composed of yellowish, brown, black, or grey ashes, mixed with pumice stones, and large torrents or beds of lavas. The whole is volcanic. Nobody can doubt of these ashes and lavas being, in former times, thrown out from several now extinct volcanos,

canos, becauſe the ſame may be now and then ſeen effected by the Veſuvian eruptions. Theſe aſhes and lava beds are but coverings of the ground, which was anterior to theſe eruptions. The queſtion is, of what nature it was?

On whatever ſide you ſet out from Naples travelling to the end of this volcanic covering, you meet there with calcareous tuf-ſtone or lime-ſtone hills, which are branches of the Apennines. Behind *monte Somma* and *Veſuvius*, towards *Sarno* and *Nola*, the ground conſiſts in calcareous incruſtations, oſteocolla, and tufo-ſtone, waſhed down from the neighbouring Apennines; which calcareous hills coming from *Terracina* run round the city of Naples and Veſuvius, and appear again on the other ſide of *Pompeja*; whence drawing nearer to the ſea, they go along the ſhore ro *Sorrento* and the ſouthern parts of Italy. Even in the ſea, beyond this volanic covering, there riſe large calcareous rocks or iſlands, ſuch as *Capri*. Hence it is probable, that the limeſtone is running under ground of the volcanic aſhes and lavas; and the more ſo, as large white limeſtones, and coarſe cubic or calcareous ſpar, are thrown out of Veſuvius, and fragments of theſe ſtones appear incloſed in the cinericious hills and lavas. Even the aſhes are ſomewhat alkaline, as ſhewing ſome ſmall effervesſcence with acids. But

But now arises another question, Whether the volcanos be produced in calcareous beds or under ground of them?

Though I cannot decide it, I have very good reasons to believe, that the limestone of the Apennines, in these southern parts of Italy, is superincumbent to argillaceous slate, as well as in the Northern ones, which have been taken notice of in my former letters. As I happened lately to travel to *Salerno* *, I saw it plainly appear from under the limestone, and rise above ground close to the road near the gates of that place. Mr. *Guettard*, who accompanied me, can attest it; and his evidence will be the more valuable, as before he had many times objected my opinion. Therefore I am inclined to believe, that, according to what has been observed in the old Vicentine and Veronese volcanos, the deepest fire-places of these in the Southern part of Italy are not in the limestone but in the slate, if not in a greater depth. There are perhaps in the slate pyriticeous veins, to whose inflammation the subterraneous fire might be owing; but I want evidences for it, as well as for many other suppositions.

* Behind the Carmelite convent, at *Salerno*, is a place in the ground, which exhales suffocating damps *(moffette)*.

The

The beſt opportunity for a general ſurvey of this volcanic covering, and of the ancient funnels whence it has been thrown out, is in the garden of the *Camaldulenſes*, taking thence a walk to the village *Nazaret*. A topographical map will facilitate it.

Veſuvio, *monte Somma*, and *Ottajano*, have been probably, in former times, but one funnel and volcano.

The *Chiaja*, now beaten by the ſea, is ſo circular, and ſo much reſembling a ſegment of a funnel, that you cannot help conſidering it as ſuch.

The *Solfatara* gives ſtill marks of former conflagrations, mentioned in a ſcarce book *; *Simonis Portii Epiſtola de conflagratione agri Puteolani*. Florent. 1551, 8vo.

Lago d'Averno, *Lago d'Agnano*, *gli Aſtroni*, perhaps too *Mare morto*, are funnels of ancient volcanos, ſunk into themſelves and filled with water, except the *Aſtroni*; which, beſides ſome pools, are covered with wood. The water in *Lago d'Agnano* ſeems now and then to boil near the ſhore, much air aſcending from under ground without any ſenſible warmth.

* But inſerted in the *Theſauri Antiquitatum Italicarum Græviani*, tom. ix. p. 9.

Monte

Monte nuovo is a hill, which, in the year 1538, during S. Michelmaſs-day, was raiſed from a flat ground to an elevation of four hundred fathom, and a periphery of three thouſand paces. During that day the ſea retired for ſome time; the country ſix miles around was burnt and laid waſte; the city *Tripergola* was deſtroyed, and the *Lago Lucrino* filled up with ſtones and aſhes. *Lettres de Mad. Du Boccage ſur l'Italie*, p. 235. and *Delices de l'Italie*, tom. iii. à Leide, 1706, p. 576 *.

Monte Gauro. or *Barbaro*, *Monti de Camaldoli*, *Sant Elmo*, *Pizzo falcone oſia l'antica Echia*, *Capo di Chino*; and, perhaps, *lo Scoglio di Revigliano*, have had likely the ſame origin †.

The iſland *Iſchia* is entirely volcanic. Such is too *Niſita*, whoſe ſmall circular harbour, called *Porto Pavone*, has likely been a volcanic funnel.

By ſo many, and perhaps a great many more volcanic funnels, have been, at different times, vomited over a pre-exiſtent ground fiery lava, aſhes, pumice-ſtones, and other eruptions. The lava did run in torrents; but the aſhes were ſpread in ſo large quantities into the air, that day-light often has been darkened, and large tracts of coun-

* Better evidence, a contemporaneous writer, the abovementioned *Simon Porta*.

† As has been proved and conjectured by *Camillo Peregrini in Campania felice in Grævii Theſ. Antiq. Italicar*, tom. ix. p. ii. p. 230.

try,

try covered by them as with ſnow ſhowers. Theſe aſhes have been in different, yea, in the very ſame eruptions, of different colour; hence it comes, that either they appear in one hill brown, in another black, in a third yellow, and in a fourth grey or white; or, that all theſe different colours offer in different thin ſtrata of one and the ſame hill; which, by that circumſtance, gets a ſtriped variegated appearance. Even thoſe of the ſame colour ſhew different beds, and theſe ſeem at firſt ſight to have been produced by water; which is an illuſion, ſince theſe beds are owing to the difference of the aſhes, which have been ſucceſſively coarſe or fine, pure or mixed, and more or leſs mixed with pumice-ſtones, of a brown, red, black, or grey colour. Theſe beds appear often in an oblique dipping ſituation, which is to be aſcribed either to the falling of the aſhes on dipping flats, or the diſordering of the hills by earthquakes. Time, preſſure, rain, froſt, and heat, have ferruminated and coagulated the aſhes to a tufo-ſtone, which is commonly yellowiſh, brown, or grey coloured. The ferruminating quality of theſe aſhes has co-operated in that petrifaction. *Pauſilippo*, and a great many other hills, as far as Cape *Miſeno*, are compoſed of ſuch tufo; and all the antiquities of this country, are either buried or built with that cinericious ſtone. *Pompeja* and *Hercula-*

Herculaneum have been covered with ashes, at present petrified, and have been built of tufo; which, together with three different lava beds, found by digging under the foundation of these cities, and in the palace-garden at *Portici*, give an idea of the high antiquity of the former eruptions. This yellow-brown tufo is frequently dug out near Naples, and commonly employed in buildings; which, for that reason, are much subject to decay. The *grotta di Pausilippo* is cut through such a hill; and sideways, to the right, are quarries where this tufo is cut into convenient square forms. Such are too at *Puzzuolo*, and behind the *Catacombes* of *S. Januario*, or the ancient burying-place; where, by long excavations, have been produced enormous caverns, even more dreary and considerable than the *Catacombs* occasioned at Rome by the same operations.

In this tufo are now and then found inclosed some adventitious bodies; which, by earthquakes, or other accidents, have been buried therein: such as, some calcined shells, acorns, chesnuts; and, if they have told me right, iron scissars, and bones, and skulls of animals. But that happens very seldom, and there have never been found in the ashes any considerable quantity, or beds of sea-shells. They contain very often copious quantities of white garnet-like globulous polygone sherl-

cryſtalliſations; which are either ſemi-tranſparen and vitreous, or changed into a clayiſh argillaceous ſubſtance. Even the red pumice-ſtones of the aſhes, which cover *Pompeja*, contain ſuch cryſtalliſations.

The ſhore from *Naples* to *Puzzuolo* is covered with pumice-ſtones, and the ſands of that ſhore are filled with a black, ſplendent iron ſand, drawn by the loadſtone; which is owing to the ſea's continual waſhing and breaking againſt the tufo rocks. The ſame ſhore offers a great number of worms, called *Aphroditæ aculeatæ*, and ſome *pila marina*, which are produced by the rolling of the fibrous roots of the *zoſtera marina*.

The looſe unpetrified aſhes, which are found in ſeveral hills about Naples, are known under the name of *terra pozzolana*. It is of different colours; that of Veſuvius is commonly black. Mixed with lime it ſerves in maſonry, and produces an excellent cement; which, probably, on account of the ferruminating iron particles (*Cronſted's Mineral*, publiſhed by *Brünnich*, p. 47.) is ſo ſtrongly coherent, that it is impenetrable and indiſſoluble by water. They dig it likewiſe near Rome, and in other places in Italy; whence, by the way of Civita-vecchia, it is exported to France, Holland, Sweden, and many other countries. The common puzzolana is yellowiſh brown; an excellent

ſort,

fort, dug near Naples and *Torre dell' annonziata*, is black; and that which is found near *Puzzolo* is grey. This is as fine and impalpable as flour.

After this deſcription of a country which is produced by volcanic eruptions, I come to *Veſuvius*, the only volcano ſtill burning. This mountain is very high, and entirely conic, ſtanding with the adjacent lava-hills *Monte Somma* and *Ottajano*, iſolate between the Apennines and the ſea. Its exterior ſides conſiſt of lava, which towards the ſea, to a great depth, is covered with black ſand and ſmall ſtones *(Rena e lapilli)*, or black aſhes and ſmall lava pieces. The top is ever ſmoking, and changed by almoſt every eruption. During thoſe of 1685 and 1689, a conical hill, five hundred palmi high, was raiſed in its funnel, wherein it was ſwallowed up, and diſappeared ſoon after. P. *La Torre* and Abbate *Botis* have given its figure. The circumference of the funnel is very large after the laſt eruptions. Its form is elliptical, and reſembles in the inner part an inverted cone. Deſcending ſeveral fathoms into it, you meet with a floor or roof of lava, which covers the deeper holes. Its ſtrength and thickneſs are unknown. It is cracked and broken in ſeveral places; and two fiſſures, eſpecially a long one gaping about a foot, continually throw out ſmoke, heat, fla-

flaming fire, aſhes, ſands, and ſtones. The whole is covered by black ſand and aſhes, green vitriol, yellow and reddiſh ſulphur, and white ſalmiac. The ſands and aſhes on this floor, and on both ſides of the funnel, are ever ſmoking, and often too hot to be walked upon. By ſtrong winds, the ſulphureous ſmoke is whirling in the funnel, and almoſt intolerable. The eruptions do not conſtantly break through the top, but often through the ſides of the mountain, from its middle. So did the laſt. The erupted lavas laſt for a long while hot and ſmoking. I found thoſe of the laſt eruption, a year after, in many places intolerably hot, and ſmoking through the fiſſures which had been produced by the coldneſs of the air. This lava torrent broke through the middle ſides of the mountain, and, having been ſtrongly boiling or fermenting at the eruption, has occaſioned by the incloſed air a ſubterraneous hole; which, according to my guides, is ſtretching, and turning into the lava-maſs, a length of about one hundred and eighty feet. They had flambeaux, and ventured into it. I attempted the ſame, as far as the heat would allow me; and I found its inner ſides, as other fiſſures of hot lavas, covered with white ſalmiac, which commonly appears on the ſurface of the lavas two months after the eruptions. If the weather be fair, and the wind driving the

ſmoke

ſmoke to one ſide of the funnel, you enjoy from the ſummit of the mountain a moſt extenſive noble view. I had that pleaſure, and drank to your health a glaſs of *lacryma Chriſti*; an excellent wine, growing upon the cinericeous fertile hills, that are adjacent to the foot of the mountain. I heard at ſeveral times under ground a hollow tremulous ſound; this is more intenſe and frequent before the eruptions, which arrive, and are apprehended, rather after continual ſtrong rains then in dry weather. Prof. *Vairo* at Naples has aſſured me, that during the eruptions of Veſuvius perpendicular iron bars are found to be electric. I ſlip over the ſuffocating damps, which will be deſcribed this year by Mr. *Bartoloni* in *Deſcription delle moffette del Veſuvio.*

I have noticed already, that the form of Veſuvius is changed by every eruption; and particularly ſo in the places of the eruptions. Many old Poets and Hiſtorians deſcribe that mountain as very fertile, and grown over with wood. Hence it appears, that for many centuries it ought to have been quiet without any eruption *(ſee Magazine of Hambrough, vol.* ix.*)*; and that many more centuries, anterior to that time of the Ancients, have been requiſite to riſe it by many ſucceſſive eruptions to its ancient form and

elevation. Is this consistent with our common Chronology *?

Monte Somma and *Ottajano* are volcanic mountains, or rather the same mountain, called at one side of Vesuvius *Somma*, and at the other *Ottajano*. It surrounds Vesuvius like a wall, in a semicircular form; is less elevated; very steep, and irregularly broken towards the valley, by which it is divided from Vesuvius. This situation, and the present condition of many similar swallowed volcanos, make it highly probable, that *Monte Somma*, *Ottajano*, and *Vesuvius*, have been, in former times, a coherent mass of a conical form, and much higher than Vesuvius; that the top of this colossal volcano sunk, and the whole mountain was swallowed into itself; that *Somma* and *Ottajano* are but part of the anterior larger funnel; that there have been new eruptions from the sunk funnel, which by accumulated lavas and ashes have successively raised the now subsistent Vesuvius in the same manner as the eruptions of 1685 and 1689 produced a smaller hill, which was

* Why not? If *monte nuovo* has been raised in twenty-four hours time, why should not Vesuvius have been raised within the compass of our Chronology, though in times much anterior to the eldest Greek historians? There are certainly much stronger arguments against that Monkish and Rabbinical system.

ſwallowed afterwards. According to theſe facts and ſuppoſitions, Veſuvius, after having burnt out, may ſink to the ground, leave but a part of its circumference ſtanding, and in its place a pool like *Lago d'Agnano*, *d'Averno*, and others in Italy.

They ſuppoſe, that there is a ſubterranean connection between *Veſuvius*, the *Solfatara*, *Ætna*, *Strombolo* *, and the Ocean. I do not know this; but there is good reaſon to ſuppoſe, under ground, large holes and excavations. Amazing quantities of combuſtible and vitreſcent materials have been ſince ſo many centuries conſumed and thrown out; and the vomiting of large ſtones ſuppoſes ſtrong currents of air in theſe long and ſpacious caverns. Certain it is, that Veſuvius has, in former times, vomited large quantities of water; and that the ſea, during the eruptions and earthquakes, is in a ſtrong commotion. They tell us that ſea ſhells have appeared together with this water.

The probable and poſſible cauſes of the ſub-

* *Stromboli* is one of the Liparean iſlands, in the Mediterranean, near Calabria; containing a mountain which is ever burning, and on all ſides ſurrounded by ſea. Some Italian Philoſophers are of opinion, that moſt part of volcanos have been, in former times, covered by ſea, and raiſed above its level by their eruptions. By this ſuppoſition, they very eaſily explain the mixture of volcanic and marine productions in the Vicentine diſtrict.

terraneous inflammations are demonſtrable by experimental philoſophy. They are many. But it is impoſſible exactly to determine to what they are owing, whether to water and pyrites, or to a fermentation of calcareous materials produced by acids or waters. According to general report, pyrites have been thrown out, though in ſmall quantities; but ſublimated ſulphur is very common on its ſmoking funnel.

The amazing quantities of lava and aſhes, vomited in ſo many eruptions during ſo many centuries, prove that Veſuvius is hollow, and that there are beſides, under ground, large holes and reſervoirs of inflammable and vitreſcent materials. The common ſinking of the volcanos into flat pools countenances that opinion. However, the lava-eruptions out of the upper funnel can be produced by its fermentation and ebullition, which overflowing the funnel have ſucceſſively raiſed it, and will continue to do ſo, till the whole fire-built conſtruction ſink into the ground.

The undermoſt and inner part of Veſuvius conſiſts probably of lavas, aſhes, and burnt materials. The remains of ſunk and extinct volcanos prove it. *Monte Somma* and *Ottajano* is the beſt evidence to the purpoſe. This mountain conſiſts of many horizontal or ſomewhat dipping beds, each one or two feet thick; and theſe are

compoſed,

compoſed, 1. Of grey aſhes mixed with pumice-ſtones. 2. Of grey blueiſh lava ſprinkled with thin and black ſherl-flakes. 3. Of black lava mixed with white garnet-like polygone ſherl-cryſtallizations. They are ſuperincumbent one to another, without any order, except that the cinericious or aſh-ſtrata are more frequent than the lava beds. Perhaps each lava bed may be conſidered as a monument of as many eruptions. Through theſe horizontal beds ſink vertical or nearly vertical veins, about three feet large, filled up either with grey blueiſh lava, which is porous and honey-combed towards the middle, and contains now and then black ſherl-flakes; or with black greyiſh lava, which contains white farinaceous decayed garnet-like ſherl-cryſtallizations. Theſe perpendicular veins may be conſidered as fiſſures, cauſed by earthquakes and by following eruptions filled with lava.

I have mentioned already ſeveral productions of Veſuvius; but I give you now a deſcription of all their ſpecies. Every eruption produces new varieties; but upon the whole they agree. Therefore I ſhall notice them without regarding, whether they are owing to old or new eruptions; and I ſhall deſcribe as many varieties as I have happened to ſee, either in different collections, eſpecially in Abbate *Botti's*, which was the compleateſt of that kind,

kind, or on Vesuvius, or in the shops and magazines of lava-sellers. I divide all these Vesuvian volcanic productions into two classes. The first is to contain raw pre-existent stones, which have been by subterraneous forces thrown out from the deepest caverns and rocks, being produced not by fire but probably by water. The second class is for the lavas, and other productions of fire. These are to be considered as compositions and vitrifications, or scoriæ of the former stones, and other vitrifying materials of the deep; and it is unhappy, that we are destitute of compleat collections, and that the veracity of the inhabitants of these countries cannot be much depended upon; whence it is dubious, whether many Vesuvian productions in the collections and shops be really such.

First Class of Vesuvian Stones.

1. *Quartz.*

a. White, compact, in large and smaller fragments.

b. White, cracked, semi-pellucid; seems to have been exposed to a great fire, and to have been half vitrified. In the collection of Abbate *Bottis.*

c. Hexagonal pellucid quartz lamellated. *Ibidem.*

d. Common and

e. Ame-

e. Amethyſtine quartz cryſtalliſations. *Ibidem.* I doubt their being Veſuvian ones.

2. *Agate*; white with red ſtripes, of the ſame kind; which, on account of the angulated ſtripes, is in Saxony called fortification-agate. *Ibidem.* To me dubious.

3. *Gypſum*, or *ſelenite*, in tranſparent lamellæ; ſimilar to the lamellated ſelenites of *Montmartre*. In the collection of *Bottis*.

4. *Amianth.* *Ibidem.* Dubious again.

5. *White*, ſcaly, or lamellated calcareous *ſpar*; conſiſting of coarſe and finer ſcales; found in conſiderable quantities all around Veſuvius, in looſe fragments, often of the bigneſs of a man's head, or even in greater ones; in the ſame collection.

6. White *limeſtone* or *marble*, in ſimilar ſtraying looſe pieces; ſome burnt and calcined; they are found likewiſe in the aſhes and lavas, and then conſtantly calcined and farinaceous. The Veſuvian guides preſented me with quantities of white calcareous ſtalactite; conſiſting of piſolithes in a maſs of globules, but thoſe were ſolid without any mark of ſcales. Though they aſſured me of theſe ſtones being frequent in the funnel, I never could find any, either there or in other places of the mountain.

7. *Hexagonal*, columnar, pyramidical, calcareous *ſpar-cryſtalliſations*. In Mr. *Bottis's* collection. Dubious.

8. *White*,

8. *White*, compact, and fine calcareous *ſpar*; or rather limeſtone with mica and ſherl-cryſtals, both of different colours. This is probably belonging to a vein *(gang-arth)*, and ſeems to ſupport my ſuppoſition of veins under ground at Veſuvius. They appear in fragments of different bigneſs; ſome as large as a man's head. Neither I, nor Mr. *Guettard*, could imagine theſe ſtones to be really thrown out of Veſuvius; we conjectured them to have been broken at *monte Somma*, or elſewhere. But having found *monte Somma* deſtitute of ſuch ſtones, and plenty of them ſcattered all around Veſuvius, we changed our opinions; and this the more ſo, as we happened to ſee in Don *Valenciani's* magazine, at *Portici*, ſome fragments, which viſibly had been affected by fire.

9. The *mica*, or glimmer, in this calcareous *ſpar*, is more or leſs hard, ſoft, and ſimilar to talc. Its colour white tranſparent, white argentine, and then fat to the touch; yellow, green, dark-green, blackiſh. Its texture lamellated.

10. Adherent to ſuch a ſpar, ſoft, looſe, and fat glimmer; of a ſplendent bloſſom colour, ſimilar to *molybdæna*. In Mr. *Botti's* collection.

11. The *ſherl-cryſtalliſations of this calcareous ſpar*, (n. 8.) are commonly found in its holes, which they cover all around. According to my opinoin, they ſeem to have belonged with the mica

and

and calcareous ſpar to a ſubterraneous vein, and therein to have been produced by water; though ſome other ſherl-cryſtalliſations in the holes of lava, which I ſhall notice after, and which owe their origin to fire, are entirely ſimilar to theſe. I have obſerved the following varieties.

a. Polygone, pyramidical, ſmall ſherl-cryſtalliſations; form ſimilar to blende; hardneſs and texture different; colour white, black, blackiſh-green, graſs or emerald green, purple or garnet-red, ruby-red, brown, and topaz-yellow. Theſe, eſpecially the brown-coloured, are moſt common in the micaceous limeſtone ſpar, and are handed about, and dearly ſold as gems, though of a leſſer hardneſs and pellucidity, and in fire aſſayed to be nothing but ſherl. The ſame is to be ſaid of the following three varieties.

b. Sherl-cryſtalliſations in flat hexagonal truncated priſms; black, dark-green, brown, and vitreſcent white.

c. Sherl-cryſtalliſations in hexagonal priſms, with a pyramidical top; flat as the former; entirely ſimilar to ſmall quartz-cryſtals; coloured as the before-deſcribed *(b)*.

d. Globular polygone, or entirely *garnet-like ſherl-cryſtals*; entirely ſimilar to the white in the lavas. I doubt whether they juſtly can be ranked amongſt the raw pre-exiſtent aqueous productions;

ductions; since the scarce samples in Mr. *Bottis's* collection were not inclosed in micaceous limestone spar, but in white quartz or green sherl spar, which is the pretended mother of emerald (*Cronst. Mineral.* § 73.)

12. *Pyrites*; some crystallised into marcasitical cubes; in all Vesuvian collections. The same from *Ætna*.

13. *Ochraceous iron ore*, either compact, or in polygone comb-like crystallisations; in all Vesuvian collections; pretended to be from Vesuvius or Ætna. But the very same species of iron-ore being common in the mines of *Isola d'Elba*, near *Toscana*, I doubt whether it really be a volcanic production.

14. *Pyritical yellow copper-ore*; pretended to be from Vesuvius or Ætna. It may be; but I am dubious.

15. *Malachites* and *azure copper-ore* on quartz and calcareous spar. Pretended Vesuvian productions; as,

16. Striated grey *antimony*, and

17. *Arsenical* pyrites, or mispickel, with sherl flakes.

Second

Second Claſſis of Veſuvian Stones and Foſſils, prepared by fire.

Before I proceed to the deſcription of the lava and other volcanic productions of Veſuvius, I think it convenient firſt to ſpeak in particular of the ſherl-cryſtalliſations, which are ſo common in the lava; and which I believe to be produced by fire, and thus far to be different from thoſe which are incloſed in the above micaceous lime-ſtone ſpar. I have ſeen the following varieties.

1. Globular polygone garnet-like cryſtals, with fifty-ſix for the moſt part rhomboidical faces; the biggeſt an inch diameter; either vitreous white tranſparent; or ſemi-pellucid leſs vitreous; or farinaceous white opaque; and in old lava, friable to a powder which does not effervеſce with acids, and is comparable to the white terraceous ſurface of flints (*Cronſted. Mineral.* in the note, § 40.) In the eldeſt lavas, eſpecially thoſe which have been long expoſed to the acid of the air, they are entirely diſſolved and changed into clay. Theſe ſherls or white garnets * are extremely common in

* Their nature and form prove them to be true white garnets; but being commonly deſtitute of the garnet-hardneſs and the lava-ſherls, whoſe ſubſtance is the very ſame, appearing under many other forms, I chooſe rather to call them *garnet*-like ſherl-cryſtals.

moſt

moſt part of the lavas of ancient and modern volcanos *, ſticking in them very cloſe together; eaſily broke out of their ſubſtance, and then leaving holes, which are exact impreſſions or mouldings of their regular forms; if broken, there appears in their middle a ſmall black-coloured ſherl-grain.

2. Opaque, white, farinaceous, long, round, columnar, and on the ſurface ſtriated ſherl cryſtals (in Saxony called *ſtangen-ſpath* or *ſtangen-ſherl* †), found in ſome Veſuvian lavas, and in thoſe which are to the right of the road from *Naples* to *Puzzuola*.

3. *Hexagonal* white tranſparent *ſherl*-columns, either truncated or pyramidical; in ſome Veſuvian lavas; ſcarce.

4. *Black ſherl-feathers*, either thin and pin-like, or ſomewhat bigger, either round or hexagonal.

* This is to be underſtood of Italian volcanos. The Heſſian lavas, which I have deſcribed lately, offer other varieties of ſherls; ſo too do the Iceland lavas in Mr. *Banks's* collection.

† This German ſtone is electric as the Ceylon and Braſilian tourmalines; and theſe laſt in their primitive ſtate being of the ſame form as the ſtangen-ſherl, there is good reaſon to rank them among the ſherls and the volcanic productions; to ſet right ſome Mineralogiſts, and to roam from the volcanic through the electrical-ſyſtems—into literary immortality.

5. Lamel-

5. *Lamellated black ſherl-glimmer*, in larger or ſmaller often hexagonal lamellæ; ſplendent; ſeem to be fragments of columnar ſherl.

6. *Black ſherl* ſprinkled in the lava in ſmall points.

7. Small, black, priſmatical, hexagonal ſherl-cryſtals; ſplendent; their form but appearing under the microſcope; waſhed by rain out of the volcanic aſhes; either drawn by the load-ſtone or mixed with iron-ſand.

8. *Green*, either dark and blueiſh, or cryſolite, or emerald-coloured *ſherl*, in hexagonal, pyramidical priſms; found in the black lava often of an inch diameter; of the hardneſs of ſherl, or, at leaſt, of a coloured quartz-cryſtal, to whoſe form it is reſembling; however, by the Neapolitans called *gemma*, or precious ſtone.

9. *Yellow* hyacinth, or topaz-coloured hexagonal *ſherl*. This too is nearly as hard as a gem.

All theſe ſherl-varieties, incloſed in the Veſuvian and other lavas, ſeem to have been produced in the lava during its fuſion. My arguments are the following.

1. There is no example of any mountain or rock, precipitated by water, and explored by miners and mineralogiſts, which is found to contain ſo amazing a quantity of ſherl-cryſtals, as are incloſed in the lavas. The ſmall numbers of the

above-mentioned raw and natural ſherls in micaceous limeſtone ſpar, are nothing in compariſon to thoſe in the lava; and they prove, at leaſt, that Nature works the ſame effects by different cauſes. Yea, there are ſome learned men at Naples, who conſider even theſe ſherls as volcanic productions, aſſerting, that the glimmer was produced as the variegated lamellated litharge in fire.

2. If, however, you would ſuppoſe ſuch a rich ſherl mine under Veſuvius, how could you ſuppoſe the ſame under all the other Italian volcanos?

3. If theſe ſherl-cryſtalliſations had been torn off from pre-exiſtent ſherl-mine-rocks and thrown out by fire, how could they, without melting, loſing their form, and mingling with the lava, reſiſt its intenſe long-laſting heat? You know it is a common quality of ſherls and garnets, to melt eaſily and to be ſcorified by candle-light; however, their cryſtallizations are found not only in the common lavas, but even in the vitrified Iceland lavas or agates, as ſhall be related hereafter.

4. How came the ſmall white garnets in the inner parts of the red pumice-ſtones, which are found near *Pompejano* and other places? If preexiſting the ſcorification, which ſuppoſes the higheſt degree of fire, they would have been deſtroyed.

5. If

5. If thrown up from under ground, why are not all ſorts of ſherls found in the lava? The above deſcribed blend-like ſherl, incloſed in the micaceous limeſtone ſpar, though with that ſpar thrown out by fire, are never ſeen in the lavas; and theſe are rather filled with white garnets never obſerved in that micaceous limeſtone.

6. There are white and black ſherl points, not above the bigneſs of a pin's head, glued into the ſubſtance of lava. How is it to be aſſerted, that theſe ſmall regular bodies have been cryſtallized before in the rocks under ground? In what other mountains are ſuch ſmall ſherl-cryſtallizations to be found? Why have they been ſo exactly ſeparated from their former rock-matrix, and been ſo equally diſtributed in the lava? The ſame queſtions will do for the greater cryſtallizations.

7. Obſerving the compacteſt black lavas by a microſcope, we find in its ſubſtance a great many white cryſtalline ſherl flakes; which prove, that they are ſubſtantial particles, which, being of a ſimilar nature, during the fuſion of the heterogeneous melted materials, have approximated and contracted themſelves into ſuch flakes or greater cryſtallizations. Such I imagine to be their origin, as ſeeing no impoſſibility that certain bodies, in a ſtate of hot fluidity, may be endowed with a tendency to determined regular forms, as well as

many others in a ſtate of aqueous diſſolution. Mr. *Cronſtedt*, in his Oration on the Improvements of Mineralogy, has pointed out ſeveral examples of mineral melted bodies, which cryſtallize in fuſion and ſublimation.

8. The black coarſe lava has, according to my former deſcriptions of the Vicentine, Veroneſe, and Paduan volcanos, the quality, to be cryſtallized by refrigeration into large columns or priſms, which are called baſaltes. Now what is baſaltes and lava but a ſpecies of ſherl? *(Cronſt. Mineralog.)* Why ſhould we deny then that ſome nearer related particles of the lava may ſeparate from its maſs and form ſmaller cryſtallizations *? This my opinion will probably be much ſtrengthened and confirmed by my repeated obſervations of a baſalt-rock near *Bolſena*, which I have ſeen near the road, and will deſcribe to you at my return. The explaining of aqueous cryſtallizations is attended with the ſame difficulties as of the fiery ones. Both ſuppoſe a ſtate of fluidity. Would we deny their exiſtence? We ſee them, though we do not, per-

* The queſtion, Why do not all lavas cryſtallize into priſmatical baſalts? or, Why do not the Veſuvian lavas ſhew that form? is the ſame as aſking, Why does not every quartz appear in cryſtallizations?

Mr. *Ferber* ſhould not have penned that note, ſince there ought to be a natural cauſe of it, whatever it be. TRANSL.

haps,

haps, conceive how they are produced. Attempt, for example, to explain by what means the red *garnets* came into their common matrix of micaceous ſlate (or *gneiſs*)? How they have been brought into that matrix in ſuch vaſt quantities as that in which they are found in Bohemia, near *Leutmeriz*, at *Zoeblitz* in Saxony, in *Hungary*, and in other places? Have they been pre-exiſtent and formed before? And how came they into the ſlate? Or, have they been cryſtallized while the maſs of the ſlate was fluid? Take whatever hypotheſis you will, a friend of contradictions and difficulties will ever have ſome at hand; however it be true, that they cannot have been produced but by either of theſe ſuppoſitions. Similar objections can be made to me, by aſking how the white garnets came into the volcanic aſhes-hills, the aſhes being thrown out into the ſkies, and thence fallen down as ſnow? But I can anſwer it by the ſtupendous forces, which, throwing the fire-conſumed lavas into the ſkies, may have pulverized and thus ſeparated the mfrom the inherent ſherl-cryſtallizations. Theſe forces indeed muſt be aſtoniſhing, if it be true that, by ſome ancient eruptions of Veſuvius, the aſhes have been ſpread as far as Rome; and, as ſome authors have aſſured, at random as far as Conſtantinople. *Dion Caſſius* relates, that the

aſhes have gone further, even to Africa, Syria, and Egypt.

This I think may be ſufficient of the ſherl-cryſtallizations incloſed in the lavas; and will be probably confirmed by my nearer examination of the ancient volcanos, near *Rome*, *Viterbo*, and *Bolſena*.

Beſides them, the black compacter lava contains ſmall pebbles, of a black, cryſolite-green, emerald-green, dark-green, hyacinth, and topaz-yellow colour. They are in nothing differing from the lava ſherls, but in their greater hardneſs and a want of a regular form. They are true flints *(ſilices)*, or natural hard vitrifications or frittas; exactly agreeing with the hyacinths, cryſolites, and pietre obſidiane, in the Vicentine lavas; and, in ſome reſpect, deſerving the denomination of gems, though their hue be ſcarce comparable to the colours of the true precious ſtones; which, being produced by an *aqueous cryſtallization*, are on no account above the ſherls, but on account of their greater hardneſs and refractorineſs *(ſchwerflüſſigkeil)* to the fire — a circumſtance, which cauſed Mr. *Cronſtedt (Mineralog.* § 68.) to ſeparate the garnets and ſherls from the quartz and horn-ſtones *(ſilices)*, and plainly ſhews, that the denomination *fine and precious ſtones*, is rather a hint of their conventional

ornamental quality, than of real and mineralogical differences. I am entirely of opinion, that ſherls and the pretended *precious ſtones* are the ſame; that the different degrees of their reſpective hardneſs are hardly to be determined; and that the conventional preference of the latter depends only upon their high prices and exquiſite colours. However, as long as any regard is paid in common life to theſe circumſtances, whatever they be, a due regard is to be paid alſo to the difference of their names, ſince it cannot be indifferent to the purchaſers, whether a common, or a rare, a ſoft, or a hard, variety of ſherl be ſold to them at equal prices *. Theſe ſcarce and hard

* The author is too good a Naturaliſt not to allow the following ſtrictures. He ſpoke of the gem-like pebbles, incloſed in the lavas, which he very juſtly obſerves to be different from the ſherls on account of their undetermined form, and to be ſimilar to the precious ſtones on account of their hardneſs and colour; but immediately after he goes aſtray, confounding them with the ſherls, and theſe even with the precious ſtones; which he plainly aſſerts to be the ſame, not altered by any real and mineralogical principle, but by ſome indefinite hardneſs, colour, prejudice, and conventional price. In this confuſion of different objects, and in this aſſertion, he certainly is remarkably wrong, if put to the teſt of Natural Philoſophy, as plainly will appear by the following remarks.

hard ſherls are part of the *precious ſtones*; accordingly, to avoid cheats and impoſtures, this name is

The *ſherls* are, according to the author's own evidence, cryſtallized in a fluid ſtate of their matrix, produced either by water or by fire; their form cryſtallized regular; their ſubſtance eaſily melting before the blowing pipe; and whatever be their origin, their hardneſs and gravity inferior to that of the volcanic vitrification-pebbles, and of the precious ſtones. To theſe the Tranſlator adds, that ſome ſherls are endowed with the double electricity of the tourmaline, hitherto never obſerved in the precious ſtones; and that their natural forms too are very different from thoſe of the precious ſtones.

The *volcanic vitrification pebbles* are immediate productions of the fire, and conſtantly found in the hardeſt lavas; entirely deſtitute of any regular cryſtalline form of either the ſherls or precious ſtones, being properly vitrifications of ſherls, as hinted by Mr. Raſpe's deſcription of the Heſſian Volcanos; their hardneſs and gravity above the ſherls, and nearly the ſame as that of the coloured precious ſtones.

The *precious ſtones* are aqueous cryſtallizations of many different regular forms; unknown whether ever found in a volcanic matrix; their ſubſtance remarkably refractory to the fire; their hardneſs, gravity, and luſtre, above the ſherls; and if not ſuperior to that of the volcanic vitrifications, they are undoubtedly differing from them on account of their colours, having them either higher and finer dyed, or entirely different.

To theſe obvious and natural mineralogical differences a Jeweller might perhaps add a great many more. However, it is very true, that the high prices of the *precious ſtones* are rather owing to old ſuperſtition, their ſcarcity, fancy, and cuſtom;

is not to be ſquandered away upon any other ſtone ſpecies. However, they ſell at *Naples* a great many poliſhed ſtones, of almoſt every colour, under the name of Veſuvian or volcanic gems, and they are accordingly received as ſuch in many cabinets; though the before-mentioned hard lava-pebbles did never appear to me but black-green and yellow-coloured: and I am perfectly convinced, that even the ſofter lava-ſherls and artificial coloured glaſſes are very often ſold by that name. I cannot be greatly concerned or ſorry for it. The ignorance of theſe gallant purchaſers is too inviting for the Italian ſubtlety; and why do they travel and meddle with Natural Hiſtory, without having inſtructed themſelves in its principles?

I am now to deſcribe as many lavas, and other Veſuvian volcanic Neapolitan productions, as I have had an opportunity to obſerve. Some of them are the matrices of the before deſcribed ſherls and pebbles.

cuſtom; that the volcanic-vitrification-pebbles, on account of their remarkable hardneſs and ſcarcity, might with juſtice claim the ſame rank; that the garnets, a ſherl-ſpecies, have been received among the ornamental ſtones; that fancy and folly may ennoble many more; and that, whatever be the natural and minerological differences of fantaſtical ornaments, a ſhell, a feather, beads, glaſs, cryſtals, and ſtones, are treaſure or traſh, as cuſtom leads, and fancy wills.

1. Black

1. Black lava, ferruginous, entirely similar to black iron-slags or scoriæ, is the most common of all, covering Vesuvius on every side, except towards the sea, where it lies deeply buried under black sands and ashes. A white lichen, which I never saw flourishing, is frequently growing upon it. Its eruptions are attended with strong ebullition and skimming, which occasions the large air-bladders or hollow caverns mentioned before. For the same reason its surface is commonly very rough and unequal, which makes the walking upon it extremely difficult. Now and then it flowed in waves, still appearing after its cooling. It is porous in the surface, spungy, and light, and therefore employed in vaulted roofs. At a greater depth it is extremely compact, and then employed in foundations and pavings of the streets. Such lava is at present chiefly dug out at the right hand of the road from *Naples* to *Puzzuolo*, from a lava-torrent of the Solfatara volcano; it is dug likewise between *Portici* and *Pompeja* from that large and terrible lava torrent, which in one of the latest eruptions run down Vesuvius across the road into the sea. They here cut the lava into square pieces, or into parallelopipedes, and ship it thence to Naples, even as far as *Salerno*, and other distant places. This black flaggish lava appears in the inner side of the funnel in the form of grapes or branch-like corals,

corals, partly mixed or incruſtated with a reddiſh iron-ochre, which is ſimilar to the colcothar vitrioli. Under theſe circumſtances it is very ſonorous; which is owing to its longer expoſition to an intenſe fire *.

2. Black compact lava, with white garnet-like ſherl-cryſtallizations; which are either vitreous, tranſparent, or ſemi-pellucid, or white opaque milk-coloured. In the moſt ancient lavas, long expoſed to the air, they are friable and farinaceous. This lava is very common, and moſt frequent, not only near Veſuvius and Naples, but likewiſe near the other Italian volcanos.

3. Black compact lava, with round ſtriated ſherl-columns, called ſtangen-ſpath; near Veſuvius and Puzzuolo, on the ſhore, at the right hand of the road from Naples.

4. Black compact lava, with white hexagonal ſherl-priſms; very ſcarce.

5. Black compact lava, with black ſherl-feathers or points, which are either thin and pin-like, or ſomewhat bigger, in a roundiſh or hexagonal form; from Veſuvius.

6. Black compact lava, with black ſherl-flakes, which ſeem to have been cracked by fire from ſherl-priſms; from Veſuvius.

* Or rather to its form.

7. Black

7. Black compact lava, with dark grass-green, crysolite-green, or emerald-green sherl, in hexagonal and pyramidical prisms, of different bigness; from Vesuvius.

8. Ditto, with yellow hyacinth, or topaz-like hexagonal sherl; from Vesuvius.

9. Ditto, with coloured blunt pebbles, or hard natural vitrifications, on account of their hardness more resembling the precious stones than the above coloured sherls. They are black, and then called *pietre obsidiane*, dark-green, crysolite, emerald, hyacinth, or topaz coloured; from Vesuvius.

10. Grey or blue porous lava, in some transversal or perpendicular veins of *monte Somma*.

11. Grey compact lava, with black hexagonal or cylindrical sherl-columns; from Vesuvius.

12. Grey compact lava, with frequent black sherl-glimmer or sherl-lamelles. The colour of the lava and the bigness of the lamelles very different. I have lavas from the dark-grey to white colour; and the lamelles, varying from larger ones down to small sprinkled points. These lavas resemble so much some varieties of fine grey granite, that one might might mistake them for granite. Their grain is rough and sandy to the touch. They are common on the road from *Portici* to Vesuvius in the stone heaps at the left, by which the vineyards of lachryma Christi are inclosed.

13. Grey

13. Grey compact lava, with white ſherl-garnets; from Veſuvius.

14. Ditto, with hexagonal ſherl-columns, or with cylindrical ones, called ſtangen-ſpath.

15. Red compact lava, of a ſanguine or red-brown colour.

a. With white vitreous ſherl-garnets, at the right hand on the road and ſhore, from *Naples* to *Puzzuolo*, near this place and the houſe of the galley-ſlaves.

b. With white cylindrical ſherl-columns or ſtangen-ſpath. *Ibidem*.

c. With ſmall milk-white points; from Veſuvius. All theſe varieties are much reſembling the Oriental porphyry.

16. Black vitreous lava, or pretended Iceland agate, is a perfect hard glaſs, and intirely ſimilar to that of Hecla. I have ſome pieces from *Veſuvius*, from *Capo di Chino* near Naples, from the iſland *Iſchia*, and from *Sora* on the limits of Naples and the Roman dominions. A green variety of this lava-glaſs is ſometimes found covering or glazing the black ſlaggiſh ferruginous Veſuvian lava, N°1. I ſaw in Abbate *Bottis*' collection a fragment of this vitreous lava, which was black grey coloured, and contained incloſed, beſides many ſmall hexagonal white ſherl-cylinders, a great many ſmall white

ſherl-ſtars. There is too a black ſpecies, with incloſed white garnet-like ſherl-cryſtals *.

17. *Lapilli del Veſuvio* are ſmall bits or fragments of the black ſlaggiſh ferrugineous lava, N° 1. are thrown out during the eruptions, and appear in large heaps.

18. *Sabbione* or *Rena di Veſuvio*, the ſame lava in grains of the bigneſs of ſea-ſand; covers Veſuvius towards the ſea.

19. *Ceneri neri del Veſuvio* are black aſhes or puzzolana, common in the inner funnel of Veſuvius,

* The Iceland-agates, or rather the black vitreous Iceland lavas, in Mr. *Banks's* collection, appear in three varieties.

a. Vitreous black, rough and coarſe to the touch; containing

α. White ſmall ſherl-flakes from the red crater.

β. Small white and black ſherl-flakes, from a Hecla Rhaun.

b. Entirely vitrified black, breaking ſcaly as glaſs; now and then

α. With ſingle white ſherl-flakes. A large fragment is very remarkable for containing ſome large round air-holes or bladders, incruſtated with

β. A white cryſtallized ſubſtance; which, on account of the compact glaſs-maſs, cannot be ſuppoſed to be cryſtallized by water, and appears ſtrongly to countenance Mr. *Ferber's* hypotheſis.

c. Blackiſh tranſparent; commonly broke or ſplit into irregular ſmall priſms or points, which bear ſome reſemblance to arrow-ſhafts, never containing any ſherl-flakes.

and

and in ſome ſtrata of the adjacent cinericeous hills; likely duſt of pulverized black flaggiſh lava.

20. Grey or white *puzzolana*, or aſhes dug in the hills near *Pozzuolo*; ſeems to be for the greater part duſt of grey cinders or pumice-ſtones, pulverized by long intenſe fire; contains ſome calcareous or alcaline particles, more or leſs effervescent with the acids. The ſame effervescence appears in the

21. *Brown* or *yellowiſh puzzolana*, common in the greateſt part of the cinericeous hills at the foot of Veſuvius or about Naples.

22. Small magnetic, black, ſplendent cryſtalline ſherl-particles; by rain waſhed from the above puzzolanic hills. They might perhaps be conſidered rather as ſmall iron-cryſtals, and certainly have been expoſed in the eruption to a ſtrong uſtulation.

23. Pumice-ſtones, grey, black, or red, productions of the intenſeſt fire, and the higheſt degree of ſcorification—found in the cinericious hills, whence they are waſhed by the ſea to the ſhore. The red pumice-ſtones in *Pompejano* are filled with white ſherl-garnets.

24. Yellow native ſulphur, plenty in the cracks and fiſſures of the inner funnel; but the ſmalleſt part has got by ſublimation a determined form, the greater part appearing in undetermined ſmall grains.

25. Red

25. Red arſenic, or arſenic mixed with ſulphur, in the inner funnel of Veſuvius; ſcarce; either undetermined or cryſtallized ſticking to lava.

26. Green vitriol, coagulating likewiſe in the inner funnel; expoſed to the air diſſolving into an humidity, which by iron-ocher is tinged browniſh-yellow, and ſells by the lava-dealers at Naples under the name of oil. But theſe people, as well as many Authors who have deſcribed Veſuvius, are of opinion, that there are in the bowels of Veſuvius large quantities of inflammable materials; ſuch as aſphalt, naphta, and petroleum. I do not know whether it be ſo or not; but I know very well, that theſe materials are neither found on Veſuvius nor thrown out by its eruptions. *P. Torre*, in his *Hiſtoire des Phenomenes du Veſuve*, p. 232. ſays: "On voit ſur la ſurface de la mer près de *Granatello* du petrole, qui ſort des rochers;" but I have not ſeen that place, and doubt whether it have any connection with Veſuvius, having been told that theſe rocks are calcareous; which, in many other unvolcanic countries, ſweat and produce petroleum and aſphaltum. The old Italian Hiſtorians of Veſuvius call even lava *bitume*, which probably may have ſeduced many modern ones into the ſame error. Combuſtible materials, as ſulphur, cannot be denied as exiſting in Veſuvius; but I never found any thing like aſphaltum.

27. Sal-

27. Salmiac *(sal ammoniacum nativum)* is sublimated in the cracks and fissures of the inner funnel of Vesuvius, and is pretty common. It is likewise sublimated in Solfatara. It appears either in solid undetermined or crystallized lumps, and proves the presence of the acid of common salt and of a volatile mineral alkali, which are requisite to its production. What is still more remarkable is its appearing in the cracks, fissures, and surface, of the erupted lava-torrents, where it begins to sublimate about two months after the eruption, when the lavas begin to cool. This proves the pre-existence and not the evaporation of the volatile salt in the mixture of the hot lava. It is, perhaps, produced in the lava. Or did it pre-exist in the mountain? Whence comes this volatile alkali? Cannot many other salts have existed in the lava? And what wonder is it then that the lavas incline to crystallize into regular determined forms, either in their whole masses or in some particles? The Vesuvian guides gather and sell the Salmiac at Naples, where it is employed to scower or to tin iron or copper vessels. The Vesuvian Salmiac is white; but that of Solfatara is yellowish.

Among the devastations of the different eruptions of Vesuvius, the most remarkable indeed is the covering and burying of three cities. They cannot have been very large, nor very consider-

able, since the houses and rooms, which have been dug out, are but small. They have been covered, not as commonly is imagined by lava-torrents, but by ashes and pumice-stones thrown like snow-showers upon them.

Pompeja is buried in grey ashes, covered afterwards by black ones. Small grey pumice-stones, and white small garnet-sherls, most part farrinaceous, are common in both. These ashes shew some effervescence with acids, and have been, by length of time, coagulated or ferruminated into a volcanic tufo, which is common too in many hills about Naples. Almost all the whole city is discovered, so that you may walk into its streets and into its houses, which have no roofs. They have discovered the gate of the city, and even the hinges and hooks upon which the gates moved. The streets are paved with Vesuvian lavas. There are on both sides rising foot-paths; and in the middle pavings you discover the tracks of the waggons. The houses are built with lime, and the following stones. 1. With calcareous tufo-stone and osteocolla, from *Sarno* near *Pompeja*, or the calcareous Apennines, running towards *Salerno* and *Apulia*. 2. With old black lava, containing white sherl-garnets. 3. With old grey or yellow volcanic tufo, containing plenty of grey pumice-stones. 4. With red porous pumice-stones, containing small

ſmall vitreous ſherl-garnets. The antiquity of *Pompeja* gives an idea of the high antiquity of theſe volcanic eruptions. But digging under the foundation of Pompeja three other different torrents of black lava have been diſcovered, which are one incumbent on the other, incloſe white garnets, and for that reaſon appear to be of the remoteſt antiquity. The ſame has been obſerved under *Herculaneum* and *Portici*.

Herculaneum is buried under blackiſh or dark-grey aſhes, affected likewiſe by acids, and containing incloſed ſmall pumice-ſtones and fragments of white marble or limeſtone. They are ferruminated into a black tufo. The theatre alone is left diſcovered; all the reſt is filled up again.

Stabia is near *Caſtell' a Mare*. This place ſeems to have been the ſmalleſt of all; therefore but a part has been dug out and filled up again. The mineral waters hereabout are deſcribed in, *Trattato delle aque acidole che ſono nella Citta di Caſtell' a mare di Stabia compoſto dà Raimondo de Majo*. In Napoli, 1754. 8vo.

I take this opportunity to tell you, that hot mineral waters are very common near Veſuvius, and other Italian volcanos; but they appear likewiſe in many unvolcanic countries, ſuch as England and Hungary, where I obſerved them in the neighbourhood of calcareous hills. Mr.

Guettard has assured me, that in France they are commonly to be met with in slate. But nothing more easy than an explanatory hypothesis of these phænomena.

After these my observations on Vesuvius, I will describe *Solfatara*.

This place seems undoubtedly to have been a volcano, which, after having been burnt out, sunk into itself, and left a crater-like ground inclosed with some remains of its sides. Its inner ground is covered by a flat roof of a white clayish earth, whose hollow sound indicates deeper caverns. There appear no flames, either in its fissures, or in the artificial holes, which for the gathering of the salmiac are dug into it; but a strong sulphureous aluminous smoke or steam, smelling like hepar sulphuris, issues out from these fissures of the floor, and from its white elevated inclosures, which surround it in an amphitheatrical form.

Rain and other waters penetrate by the cracks of its floor into its subterraneous caverns; become there boiling by heat; dissolve the saline and sulphureous materials; evaporate in steams, or run with a sensible noise by subterraneous canals and caverns to the other side of Solfatara, where in the *Pisciarelle* they appear rising from under ground. These *Pisciarelle* are two or three small spoutings of hot aluminous and sulphureous water,

on

on the exterior ſide of the lava hill, which incloſes the Solfatara, iſſuing there with ſome noiſe under ground in a valley at the foot of this hill, which by ſulphureous acid is changed into white clay, and is called *monte Secco*. The murmuring noiſe of the water may be explained by its boiling from the heat of ſubterraneous fire; or by an ignition and fermentation of humected martial ſulphur pyrites; or by a fermentation of the ſulphureous acid with calcareous ſubſtances, which may be ſuppoſed exiſting under ground; ſince it is highly probable, that the calcareous Apennines, which incloſe Naples on every ſide, are inferior here to the ſuperincumbent volcanic covering. The preſence of the ſulphureous acid in the ſubterraneous caverns of Solfatara is plainly evidenced, by the native cryſtalline ſulphur flowers, ſublimated on the argillaceous ſurface of its floor and ſides, and by the alum, vitriol, and ſelenite, which is here produced. But ſalmiac being likewiſe gained in Solfatara, there ſhould be in its earth the requiſite ſubſtantial acid of common ſalt and a volatile alkali.

The rocks and walls, which ſurround the plain floor of Solfatara, are for the moſt part ſtratified and white like lime-ſtone. They might even, by their appearance, be miſtaken for lime-ſtone; but upon nearer examination they appear to be argillaceous,

and there is no doubt of their having been originally lavas and aſhes of the ancient volcano, penetrated by the hot ſteams of ſulphureous acid, and by them changed into an argillaceous nature. Mr. *Beaumé*, a very ſkilful and learned chemiſt at Paris, has deduced *, from a great many aſſays, and from a great many experiments, that clays are produced by a cloſe connection of ſulphureous acid, with vitreſcent or vitreous earth. The aſhes and lavas of the ancient Solfatara volcano have been undoubtedly, as every other volcanic lavas or aſhes, of a vitreous or vitreſcent nature, and theſe appear at preſent changed and argillaceous. Some fragments of this lava are but half or at one ſide changed into clay, which either is viſcid or ductile, or hard and ſtony, and reſembling a white limeſtone. In ſome appear ſtill the forms of the old incloſed white garnet-ſherls, which are ſo common in the Italian lavas; and are likewiſe in this Solfatara clay changed and argillaceous †. Gene-

* In his Treatiſe on clays.

† I have noticed already that theſe ſherl-cryſtallizations appear very often in the moſt ancient lavas opaque, milky, and friable into a white powder, which is argillaceous, and owing to the acid of the air. I cannot help obſerving here, that the white or coloured potters and china clays and boles, in the Vicentine volcanic countries, may be volcanic materials, changed into clay by ſubterraneous ſulphur acid.

rally

rally these changed volcanic materials are of a white colour; but there are too, red, cinericeous, blueish, and black-coloured ones, as for example, near the before-mentioned *Pisciarelle*.

This undoubted change of volcanic vitreous materials into an argillaceous nature by the sulphureous acid, which did, during so many years, slowly penetrate, dissolve, and change them, is certainly one of the most singular, and most significant phænomena in Nature.

It certainly is worth while to expose Vesuvian lavas and other stones to the steams of Solfatara, and to observe their successive alterations. Professor *Vairo* at Naples has promised me to make these experiments.

It is a known fact, that clays, by burning in fire, are deprived of their viscid coherent quality, which cannot be restored to them, neither by the finest pulverization, nor by the most curious humectation. But the sulphureous Solfatara steams restore it, as may be easily observed on the broken pots wherein they gather the salmiac. Though very well baked and burnt at Naples, they are mollified again by the acid steams into a viscid clay, which keeps the former fire-burnt colour.

The clays and stones at the *Solfatara* are, by the super-abundance of the sulphureous acid, brought to distill into aluminous lumps, to which

very often native alum is found ſticking. Nature wants here no artificial aſſiſtance, but the bare accumulating of clay in ſuch places where the acid ſteams are moſt frequent.

Mr. *Beaumé* has proved, in his quoted Treatiſe, that ſome ſulphureous acid cloſe connected to much vitreſcent earth produces clay; but that by a greater quantity of acid the clay becomes aluminous—the very thing which happens in Solfatara, and is practiſed every day by the ignorant unphiloſophical alum-makers, in gathering clay from the ſurface of the floor and the incloſing rocks, and putting it in heaps around thoſe places of the floor whence the ſulphureous ſteams ariſe ſtrongeſt, to have it the more penetrated and enriched by alum. This being done, they bring the clay into open tubs, and lixiviate it with water from the *Piſciarelle*, which is alſo ſomewhat aluminous. The cleared brine is afterwards put into ſquare lead-pans, which to the brim are dug into the hot bottom of the Solfatara. The ſubterraneous heat makes it boil; and, to ſtrengthen the aluminous water, they put large pieces of hard aluminous rocks into it. Being ſufficiently evaporated, they mix ſome urine or pot-aſhes into it, in order to take away the ſuperfluous acid, and then put it, without any percolation, to cryſtallize in ſmall round tubs. That is the whole manipulation

pulation of making alum at the *Solfatara*. The lead-pans laſt for a hundred years and more.

There is in ſome parts of *Solfatara* ſome native green iron-vitriol, but in no conſiderable quantity. If they expoſed to the acid ſteams of *Solfatara* iron-filings, or the iron-ſand, which is ſo common on the ſhore from *Naples* to *Pozzuolo*, they would probably produce larger quantities of iron-vitriol, and at a cheaper rate. By a ſimilar operation they might produce copper-vitriol by copper-filings.

Selenite is found on the incloſing walls of *Solfatara*, either in undetermined lumps or formed like ſtalactites. Being often grown in feather-like fibres, ignorant Mineralogiſts call it *alumen plumoſum*.

In former times they gathered the ſulphur-flowers or lumps from the ſurface of the clay-heaps accumulated near the ſteaming fiſſures, and diſtilled them in earthen retorts, which they had ſent from Rome; but, the operations being too expenſive, they have dropt it.

Small cryſtals of *red arſenic*, native *ſulphur*, and *alum*, do likewiſe ſublimate on the ſurface of theſe clay-heaps or the incloſing walls, either in ſmall lumps or lamelles, and many different ſmall cryſtalline forms.

There

There is at preſent but a ſingle artificial hole in the floor, where they gather *ſalmiac*, in the following manner: They cover this hole with looſe fragments of broken pots and tiles, in which the riſing hot ſteam depoſes and ſublimates the ſalmiac, which here commonly is yellow. In former times they catched the ſalmiac in many other ſuch holes, which they call *fumarole*; but you can dig many holes in the ground without meeting with ſalmiac-ſteam; which convinces me, that the ſubterraneous mixture of the minerals is not every where the ſame. I have mentioned already, that ſalmiac is ſublimated likewiſe on the ſurface of the lavas, and in the crater of Veſuvius. This being conſtantly white, it ſeems that the yellow colour of the Solfatara-ſalmiac is owing to ſome iron-particles.

It is remarkable, that the ſoil of *Solfatara*, which ſeems unfit for vegetation, and proves ſo to other vegetables, is covered with plenty of *arbuſtus unedo* and *erica carnea*.

To conclude this long epiſtle, I ſhall add, only, a few words on ſome curioſities of *Pauſilippo*, the adjacent country, and the Iſland *Iſchia*.

The whole *Pauſilippo*, as far as Cape *Miſeno*, and further, conſiſts of hills of volcanic aſhes and ſome lava-torrents. In theſe are the antiquities, which have been deſcribed in many books, and

and which I ſhould not mention, if it were not to tell you that they are buried in volcanic aſhes, or built of tufo, and moſt part half-hid aſhes. I have ſeen them all, and give their names.

Tumulo di Virgilio.

Grotta di Puzzuoli oſia Pauſilippo.

Tumulo di Sannazaro, in the church of the Servites on the Pauſilippo.

Scuola di Virgilio, ſunk into the ſea.

Tempio di Giove Ammone, built of lava at Pozzuolo.

Coliſeo di Pozzuolo.

Labirinto di Nerone, near that place.

Ponte di Caligola, near Puzzuolo, built of lava in the ſea.

Caſa di Cicerone,
Tempio di Nettuno,
—— *di Adriano*,
—— *di Serapis*,
} near Pozzuolo.

The remains of this beautiful temple are near to the preſent ſea-ſhore, and have been but of late dug out of the aſhes which covered them. Three large columns, of a white-grey antique marble, ſtood upright on their ancient pedeſtals. At the middle of their length, which is about nine French feet above the preſent level of the ſea, they are all around their ſhafts for one or two palmi much worm-

worm-eaten by *pholades* or *dactylites*, marine insects, whose shells are still to be seen, and remaining in the many holes which they have bored. Over and above this place, there is nothing like such holes to be seen on these columns. Now as these animals only live in the level of the sea, and never domiciliate themselves under it, or in rocks above it; it is a natural consequence, that the sea, during some time, must to have been nine feet higher, and suddenly have fallen to its present level *. The fact deserves the more attention, as some adjacent antiquities, as the temple of Neptune and Adrian, are situated above this temple of Serapis: and as, for that reason, the latter seems to have been, in former times, upon the same level, and to be sunk under it; in which case, the sea ought to have decreased nine French feet more †. I do not decide any thing about that; but

* A very rash consequence! Cannot the marble have been worm-eaten by the Pholades before it was cut into columns, and set up in that form at Puzzuolo? May not these columns by accident have been lost for some time in the sea, and afterwards reared in the temple of Serapis? Or may not the ground have sunk for some time under the level of the sea, and afterwards been raised again?

† If there was no fact of any ground raised by earthquakes, subterraneous fermentation and fire, and none of the beforementioned suppositions were to be admitted, this supposition

but the before-mentioned observation is fact, though I do not attempt to explain it. The effects of earthquakes on the sea are known, and cannot be doubted *; but a difference of nine feet is very significant. A French officer of the engineers, in Corsica, Mr. *Barrat*, has sketched the whole situation, and given his plan to Mr. *Guettard*, who has promised to make use of it. Some broken columns and decorations of this temple, which have been found lying under its ruins, and perhaps were placed at the same elevation as the worm-eaten columns, shew likewise some pholade-holes; but, besides them, none are to be observed in the whole temple.

Behind this temple, in the adjacent cinericious hill, in which appears a small lava torrent, is a small grotte; and they assured me, that now and

tion would do; but as that is not the case, it is entirely precarious, as generally are the pretended facts and suppositions in behalf of the Malletian or Telliamedian diminution of the level of the sea.

* The author goes again astray, seeming here to hint but at the strong commotions of the sea during the earthquakes, and entirely to forget the effect, which of course they have on the ground and the bottom of the sea. The first produce but momentaneous effects and overflowings; but the latter produce very often permanent ones. See the island *Santerini*, and many other of that kind.

then

then heat and poiſonous damps are obſerved in it; but I found neither.

Monte Nuovo is already ſpoken of.

Tripergola, a market town ſwallowed up by the ſea, together with the adjacent famous *Lago Lucrino* *.

Lago d'Averno, an old crater.

Grotta della Sibylla Cumana.

Luogo dell' antica citta di Cuma.

Arco felice.

Ciſterna d'Aqua di Cuma.

Monte Falerno, celebrated by Horace's favourite wine.

Bagni e ſtufe di Tritoli oſia di Nerone—are ſeveral rooms cut in the volcanic tufo-hill; ſome of them are intolerably hot. In one of theſe grottos, which is obliquely running into the rock, the heat is ſo intolerable, that naked people in two minutes diſtill with ſweat. The heat ſtopped my reſpiration, and I could not go in them above thirty paces. Diſtant one hundred and thirty paces from the entrance is a hot aluminous water, about one palm deep, which hardens eggs in a moment.

Palazzi di Nerone.

———— *di Giulio Ceſare.*

Tempio di Mercurio.

* Rather buried and filled with aſhes.

Stanza

Stanza di Venere e di Diana.

Tempio di Venere.

—— *di Diana.*

The old city, caſtle, harbour, and promontory of Baja.

Bagni della Luna.

—— *del Sole.*

La piſchiera d'Ortenſa.

Porto di Bauli, is a ſmall charming gulph; where, in the month of January, we dined once in open air, under the ſhade of a fig- and mulberry-tree, with ſo much delight, that the impreſſion of this fortunate climate, and of the noble view we enjoyed, will never be loſt in my memory.

Sepoltura d'Agrippina.

Prigioni di Nerone.

Piſcina mirabile.

Campi Eliſi, with ſeveral old tombs.

Mare morto.

Theatro di Lucullo.

Villa di Lucullo.

L'acqua di Fenocchio di M. Lucullo; thus called, on account of the fennel which grows thereabout, and employed for that reaſon to bathe or waſh the eyes.

Grotta dragonara di Marco Agrippa; wherein, in

former times, has been a magnificent reſervoir of freſh water.

Piſchiera d'Agoſto.

Capo e porto di Miſeno.

Near the Solfatara and the Piſciarelle, is *Lago d'Agnano*, an old volcanic crater; and juſt by

I Sudatori di S. Germano, being rooms cut in the tufo, and remarkable for their hot ſprings.

Grotta del cane is a ſmall cavern in a lava-hill, which deſerves notice, the other grottos being in tufo. It is about a man's heighth, and about four paces in length; ſituated cloſe to Lago d'Agnano, which is a ſunk crater of an old volcano, having the form of an amphitheatre, and being incloſed by cinericeous and lava hills. The grotto is cut in a part of this rocky incloſure, and is renowned for the killing damps, which riſe from its ground about a palm above its floor, move along it as a white ſmoke, and ſpread through the door in the open air. Theſe damps are ſaid to be acid and ſuffocating as the acid of common ſalt; and, according to their effects, their dangerous quality ſeems to ariſe from a want of elaſticity in the air, which alone is ſufficient to ſuffocate a dog or other animals forced into them for a long while; becauſe, being but a ſhort time expoſed to theſe damps, and immediately after brought into open air, or thrown in the Lago d'Agnano, they quickly

quickly recover life and motion. Their being arſenical, as pretended by ſome accounts, is contradicted by experiments. It is ſingular, that theſe damps riſe but juſt above the ground, and that the other air of the grotto is entirely unaffected by them. Profeſſor *Vairo* has aſſured me, that in theſe damps the muſcular fibres of animals have no irritability; that there is no electricity; that the load-ſtone draws no iron, but that the needle is remarkably declining. It is likewiſe a fact, that burning flambeaux extinguiſh near the ground.

I have mentioned already that the Iſlands *Iſchia* and *Niſita* are volcanic. Lavas are common there, and they furniſh the black vitreous ſpecies, called Iceland agate. They export thence to Naples a red and grey clay for the potters manufactories.

The hot waters, which ſpring in many places at *Iſchia*, have been deſcribed in ſeveral books, eſpecially in the following ones:

Dé remedi naturali, che ſono nèlle Iſola di Pithecuſa oggi detto Iſchia. Libri ii. *Di Giulio Giaſolino.* Napoli, 1751. 4to. Ediz. ſeconda, 1763.

Camilli Eucherii de Quintiis Inarime, ſeu de balneis Pithecuſarum. Libri vi. Napoli, 1726. 8vo. *maggiore.*

Padre *Torre*, in his Hiſtory of Veſuvius, ſpeaks likewiſe of theſe hot mineral waters.

The Iſland *Capri* is calcareous.

Procita is a very ſmall Iſland, and, as they told me at Naples, covered with volcanic aſhes.

LET-

LETTER XII.

Rome, March 5, 1772.

THE length of my laſt letter, from Naples, will atone for the ſhortneſs of this, which is intended only for the deſcription of my journey.

The country from *Naples*, by *Capua* to *Mola*, is generally flat, except ſome hills which run along the calcareous Apennines. Theſe hills, and the plains, under the vegetable mould, conſiſt of ferruminated volcanic aſhes, wherein a great quantity of pumice-ſtones is incloſed.

Behind *Mola* the road aſcended into the Apennine calcareous hills; ſome of them were ſtill covered with ſnow. In a continental chain, they ſtretched to

Terracina, which is a ſmall place, and a harbour very well ſituated on a fine golfo, ſheltered by high mountains againſt the Northern winds, and very fertile in corn, wine, pomegranates, and lemons, which grow here ſpontaneouſly in the fields in

tufts or small forests. *Narcissus Tazzetta* grew here in plenty on the borders of rills in the fields, and filled the air with agreeable fragrancy.

From *Terracina* to *Piperno* the calcareous hills continued. This place is situated on a high calcareous hill. Some miles distant from *Piperno* I passed a large forest of olive-trees, belonging to the adjacent monastery called *Casa nuova*. The soil thence to *Piperno* was sandy. On both sides of the road the fields and hills are covered with a fine sanguine red and ochraceous sand. The darkness of the evening hindered me from observing whether this red colour might not perhaps arise from red puzzolana or volcanic ashes; which is the more probable, as at Rome they call *Piperno* a greenish volcanic tufo, probably first discovered in this country, and very well agreeing with red puzzolana. I was told, that there is near this place a limestone quarry.

From *Piperno* we descended on this calcareous hill till we arrived within a few miles of *Sermonetta*, where the country begins to be plain and flat. The Pomptine swamps are to the left, and the Apennines run to the right. These swamps are inhabited by a great many buffalos. The smell of the air, and of several hot springs, near the road, which depose a white terracous sediment, is so sulphureous, that it was offensive, and is said

to

to be ſtill more ſo in hotter weather. The innkeeper at Sermonetta, and his whole family, have a yellowiſh complexion; and generally, the inhabitants of this country are much ſubject to agues, quartan, and other fevers.

Behind *Sermonetta* to *Veletri* the Apennines run more to the right, though ever in view; the country becomes plain, and is, half way to *Veletri*, covered with red volcanic aſhes, from which a heavy rain had waſhed a great quantity of black iron-ſand, or ſmall magnetic ſherl-cryſtallizations. Nearer towards *Veletri* this red puzzolana is heaped into ſmall hills, which ſeem to be produced by the old eruptions of the adjacent *monte Albano*. This extinct volcano is a high mountain, with two old funnels at its foot, which are ſunk into two lakes, called *Lago d'Albano* and *Lago di Nemi*. The mountain is but a reſiduous part of the former volcano. Having reſolved to examine it in an excurſion from Rome, I only obſerve now, that this mountain conſiſts of a ſort of ſtone, which the Romans call *Piperino*, and is properly a greeniſh-grey ferruminated volcanic cinericious ſtone, mixed with black ſherl-lamelles, and farinaceous white garnet-like ſherls; now and then it is perrupted by large torrents of black lava, which is employed thereabout in maſonry and pavings.

Some Italian miles on this ſide of *Veletri* the road goes over the wide ſtretching foot of *monte Albano*, near *Lago d'Albano*, and deſcends ſuddenly into the plain which extends to Rome, and is but now and then interſected by hills. Theſe hills are compoſed of ferruminated yellow, red, grey, black, or white volcanic aſhes, with the common calcined or farinaceous garnet-like ſherls; and yield in the roads, after rainy weather, great quantities of the black magnetic iron-ſand, or ſmall ſherl-cryſtals.

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LETTER XIII.

Rome, March 30, 1772.

THE fine Spring ſeaſon, which in this happy climate we have already enjoyed, has adorned the fields and gardens with many plants, that are peculiar to the Southern parts of Italy; and the ever-greens, darkened by the Winter, appear more agreeable in their new dreſs. I mention to you only thoſe that are flouriſhing already in the fields, referring you for the reſt to the future *Flora Italica* of Dr. *Turra*, at Vicenza; to whom Mr. *Correa* and *Serra*, a Portugueze, has communicated his obſervations on the Roman and Neapolitan plants.

Ixia Bulbocodium grows in the wet grounds near Rome.

Anemone Apennina in the Apennines, and upon the woody hills, eſpecially near *Fraſcati* and the ſpring of the *Nymphe Egeria*.

Reſeda undata at the ſame place; and on the ruins of the Colliſeum, and other ancient buildings.

Roſmarinus officinalis on ancient ruins.

Geranium Romanum in the fields on the other ſide of the Tiber, and in the meadows.

Theligonum Cynocrambe on the ſtairs and terraces in the garden *della villa Corſini.*

Orchis papilionacea, bifolia, pyramidalis, morio, maſcula, militaris, latifolia, & maculata, in wet meadows, eſpecially in the *Villa Borgheſe.*

Ophrys ſpiralis, monorchis, ovata, in the ſame place.

Serapias latifolia & longifolia, in the *Villa Borgheſe.*

Croton tinctoria in the fields, not yet flouriſhing.

Aſphodelus ramoſus in the higher fields, and on the hills between Rome and Naples.

Crocus ſativus in the meadows.

Arum maculatum & ariſarum near the hedges, and in wet places in the *Villa Borgheſe.*

Hyacinthus non ſcriptus on different hills.

Orabanche major common.

Erica cinerea on calcareous rocks between Naples and Rome near Terracina, and on ancient walls at Rome.

Silene Gallica in the fields.

Cheiranthus Cheiri on ancient ruins.

Fumaria capreolata every where on ſtone walls.

Coronilla ſecuridara in the meadows.

Lapſana rhagadiolus common.

Valantia muralis on old walls.

Tar-

Targionia hypophylla near *Frascati.*

Riccia glauca in the gardens of *Villa Ludevisi.*

Tramella in the *Villa Borghese.*

Several *Mnia, Brya, Hypna, Agarici, Boleti, Lycoperda, Mucores, Byssi,* and small *Lychenes,* in the willow tuft and the plantation at the entrance of *Villa Borghese,* adherent to the trees and to the wooden fence.

Marchantia cruciata near the inclosures of the spouting waters in the *Villa Ludovisi.*

Chara vulgaris, Ulva Linza, and other species of Ulva, in the water reservoirs of different villas.

The *Palm-tree* or *Phœnix dactylifera, Agave Americana,* and *Cactus Opuntia,* bear the climate of Rome and Naples, growing spontaneously in the fields, though less frequent than near Naples and the Southern parts of Italy.

The artificial hedges, fences, and alleys, in the gardens of the Roman villæ, consist in the evergreens, which are flourishing, or have already lost their flowers; such as

Prunus Laurocerasus.

Laurus nobilis.

Arbutus Unedo, grows likewise spontaneously on the Euganean hills near Padua. The fruit, resembling wood-berries, is eaten in Italy.

Pistacia Lentiscus.

Bignonia radicans, not in flower so soon.

Juni-

Juniperus Sabina.
Viburnum Lantana.
Taxus barrata.
Cupreſſus ſemper virens.
Myrtus communis, later in flower.
Buxus ſempervirens, growing into large trees.
Cercis Siliquaſtrum, leſs employed in hedges then its beauty deſerves, which is very inviting and pleaſing by its bloſſom-coloured flowers. This ſhrub grows ſpontaneouſly at the *Porta del Popolo* near the *Muro ſtorto*, and the *Villa Borgheſe.*
Citrus medica, and
Citrus Aurantium, flouriſh later.
Thuja occidentalis et orientalis.
Liguſtrum vulgare.
Philadelphus, later in flower.
Staphylaea pinnata.
Jaſmini variæ ſpecies, later.
Punica Granatum likewiſe.
Phillyrea anguſtifolia et latifolia.

I do not entertain you with a deſcription of the many Roman villas. They will certainly be better ſeen by you than poſſibly they could be deſcribed by me.

The beauty of the Italian gardens and views is partly owing to ſpontaneous foreſts, or planted tufts of deciduous trees and ever-greens, whoſe variety

variety is extremely pleasing to the eyes. Of the first kind there are,

Quercus Ilex, Suber, Ægylops, Robur.
Platanus orientalis.
Several *aceres.*
Populi.
Betula alba et Alnus.
Carpinus Betulus et Ostrya.
Ulmus campestris.
Æsculus hipocastanum.
Fagus sylvatica et Castanea.

Of ever-greens there are,

Pinus sylvestris, abies, picea et larix.
Cupressus semper virens.

The Botanic garden, *Giardino da semplici*, belonging to the University, or the *Collegio della Sapienza*, is well provided with exotic plants, sufficiently spacious, though planted without much respect to symmetry. Its Inspector is a surgeon, Mr. *Liberato Sabati*; and the Professor of Botany, Abbate *J. F. Maratti*, gives here in summer his lectures. These gentlemen are publishing *Theatrum Horti Romani*; or, descriptions and coloured prints of the finest, most useful, and most scarce, exotic plants; which, according to their account, are kept in this garden. The first volume, in large folio, is finished, and sold by *Bouchard* and

Gravier, at Rome. The *coloured* copies are often too lively; the figures are true, but generally without the sexual parts; for the authors have no consideration for the Linnean system, following rather that of *Tournefort*. Mr. *Maratti* is known by,

Descriptio de sera florum existentia, vegetatione et forma in plantis dorsiferis seu epi-phyllospermis vulgo capillaribus a J. F. Marattio. Romæ, 1760 *.

This performance has been criticized by Mr. *Adanson* at Paris; but by a friend of *Maratti's* defended, in the twentieth volume of the *Nuova Raccolta d'Opuscoli Filologici*, printed at Venice by *Simone Occhi*, *Botanophili Romani ad R. Cl. Virum J. C. Amadutium Ariminensem Epistola qua Cl. Virum J. F. Marattium ab Adansonii censuris vindicat.*

I have made an excursion to *Ostia*, to see the disemboguing of the Tiber into the sea. This place is, at present, a village inhabited by malefactors banished from Rome. Its air is very unwholesome in summer-time. The road which brought me there is the ancient Roman *Via Ostiensis*, and paved with black compact lava, as found in *monte Albano*, especially near *Grotta ferrata*. They were repairing it when I passed by, and

* Inserted in *Raccolta d'Opuscoli Filologici*.

this

this gave me an opportunity to make a moſt inſtructing obſervation. I ſaw in ſome broken lavas little empty holes, of the bigneſs of a walnut, incruſtated all around their inner ſides by white or amethyſtine ſemi-pellucid, pointed, or truncated pyramidical cryſtallizations, entirely reſembling the agate nodules or geodes, which commonly are filled with quartz-cryſtallizations. There was no crack or fiſſure in the ambient compact lava; the cryſtal ſherls pretty hard, and I might rather call them quartz. In the reſt of the holes I ſaw ſome fine browniſh duſt, impalpable and light as aſhes. This obſervation ſeems to give a ſtrong evidence for the poſſibility of cryſtallizations in fire, and to explain the origin of the white garnet-like ſherls in the Italian lavas, which I have mentioned ſo often in my former letters.

The road from *Rome* to *Oſtia* is all volcanic aſhes till within two miles of *Oſtia*; where I obſerved an argillaceous marl, and, for the moſt part, ſandy ground with incloſed ſea-ſhells, proving its having been produced by the alluvions of ſea ſands. A great number of ſea plants, which appeared on it, confirmed that opinion. I obſerved the following ſpecies: *Polygonum maritimum*, *Scirpus maritimus*, *Vitex agnus caſtus*, *Triglochin maritimum*, *Clypeola maritima*, *Chelidonium glaucium*, *Tamarix gallica*, *Piſtacia lentiſcus*, *Myrtus commu-*

communis, *Punica Granatum*, *Liguſtrum vulgare*, *Ceratonia Siliqua*, and ſeveral others.

The ruins of the old celebrated city of *Oſtia* are behind the village. This was in former times a trading place and a ſea port, where the ſhips unloaded the Ægyptian marbles. Immenſe quantities of large blocks of *Serpentino antico*, and ſome of *Porfido roſſo*, are ſtill found near that place, and ſometimes tranſported thither by the Roman artiſts. But the old *Oſtia* lies at preſent about an Italian mile diſtant from the ſea; and accordingly all that ground has been, ſince the times of the Romans, gained from the ſea.

The place where the *Tiber* diſembogues in the ſea is called *Fiumicino*. I did not go there; but know by Mr. *Guettard* that there are ſome hills of rolled pebbles, ferruminated as a coarſe breccia, and blunted by rolling on the ancient ſhore.

LETTER XIV.

Rome, April 10, 1772.

IN this Letter I ſhall give you an account of my journey to *Tivoli*, *Paleſtina*, and *Freſcati*, and of ſome places nearly adjacent to Rome.

From *Rome* to *Tivoli* I went over fields and hills of volcanic aſhes or tufo, to the ruined *Caſtell' Arcione*. Here I ſaw calcareous incruſtations of roots and plants, commonly called *oſteocolla*. They are owing to the inundations of the *Lago de' Tartari*, ſituated at the left of the road. Its water has a ſtrong ſmell of *hepar ſulphuris*, and gets its calcareous particles either from the depth or from the neighbouring Apennines. On the other ſide of the *Lago de' Tartari*, till we came to *Tivoli*, the inferior volcanic aſhes are almoſt every where covered by theſe calcareous oſteocolla. Somewhat further, and to the left, is *Lago di Zolfo*, and *Lago de' Bagni*, both ſmelling like *hepar ſulphuris*. Though cold, it throws up from the bottom large air-bladders like boiling water, eſpecially if ſtones

ſtones be thrown into it. It is ſaid to be fifty feet deep, and is celebrated for its ſmall floating iſlands, which are grown over with graſs and reed. A ſmall brook running from the *Lago de' Bagni* forms by its incruſtations the *Luſus naturæ*, called *Confetti di Tivoli*. From the *Lago di Zolfo* to *Tivoli* the country is flat; but here it aſcends to the city, which is ſituated on a calcareous hill of the Apennines. This hill is towards the valley covered by a large calcareous incruſtation, produced by the waters, which, deſcending from the Apennines, run over this hill in the valley, and have incruſtated the whole ground as far as *Caſtell' Arcione*. The incruſtations ſticking to the ſteep ſides of the *Tivoli* hill, are wave-like and twiſting, lamellated like the ſprudel-ſtone at Carlſbad. They often contain incloſed large lumps of oſteocolla or incruſtated roots and branches of trees, which either are penetrated by the calcareous water and petrified, or have left impreſſions filled with a calcareous ſubſtance.

From *Tivoli* to *Villa d' Adriano* the road deſcends the hill, and runs afterwards over volcanic tufo, which lies bare and uncovered. This ground continues to the Villa d' Adriano, whoſe antique walls are built of its ferruminated aſhes, in a method which the Ancients called *Opus reticulatum*. Volcanic tufo is likewiſe ſeen inferior to the cal-

careous incruſtation on the aſcent of the calcareous hill of Tivoli, near a bridge in a cavern to the right hand of the road; which proves, that theſe ſuperincumbent incruſtations are by far poſterior to the volcanic aſhes.

The porous limeſtone produced by the calcareous waters on the deſcents, and on the foot of the Apennines near Tivoli, is called *Pietra Travertina*. It is commonly uſed at *Rome*, *Tivoli*, and other places, in the maſonry of churches and private houſes. Though found in many other parts of Italy, its original local name is become in Italy a generical one, and it is called every where *Pietra Travertina*. The quarries, whence came that name, are three Italian miles diſtant from *Tivoli*, and are in ſome large hills immediately under the Apennine-limeſtone mountains. The rubbiſh of theſe quarries is burnt in large heaps to quick-lime.

Grotta di Nettuno is a deep ravin in the hill of *Tivoli*, by which the great caſcade of *Teverone* falls into the city. This river depoſes likewiſe calcareous ſediments, and many Travertino hills ſeem to be produced by its former inundations or beddings.

Le Caſcadelle deſcending from the ſame hill are very fine. To the right of the road, which leads to the oppoſite part, whence theſe caſcades are beſt

seen, there appear in the compact limestone-hills several small horizontal strata of *white-grey horn-stone-flints*, alternating with the limestone, two or three inches thick. Some of them are half lime-stone and half flint *.

From *Tivoli* to *Palestrina* the road descends from the city over calcareous sediments. Volcanic tufo offers in the same line with *villa d'Adriano*. Hence the rain had washed plenty of little black sherl-crystals; which, opposite to the sun, made the road resplendent and glittering all over; the Apennines in view to the right; the high volcanic hills of *Frescati* to the left. *Palestrina* is situated on a lamellated shivery calcareous hill in the chain of the Apennines. I saw in the palace the famous antique Musaico, which in former times was the floor of the Temple of Fortune. The blue stones coloured with cobalt.

From *Palestrina* to *Frascati*—descending from

* The Translator remembers to have seen a similar phæno-menon in the limestone quarries at *Petersberg*, near *Goslar*, in *Germany*. The limestone is whitish, of a fine grain, containing some scarce petrifactions of *Ostreæ majores, tenues, rugosæ, Ostreo pectinites, Ammonites*, and *Echini mammillares*. Its beds are turned up almost to a vertical position; and in their compact solid substance appear masses of grey-brownish hornstone flint, which cannot be considered as adventitious, but are parts of the marine stratum in which they have been produced.

Pale-

Paleſtrina over the limeſtone, you meet with volcanic tufo, mixed with ſmall farinaceous garnet-ſherls, large lumps of black lava from the adjacent volcanos, and with black and greeniſh ſherl-mica, or lamellated ſherl. Much ſherl-cryſtals are waſhed out by the rain. The whole country, for eight or nine Italian miles, is a flat plain of volcanic aſhes or tufo. Some miles on this ſide of *Fraſcati*, the road aſcends to very high volcanic tufo-hills, paſſes by *monte Algido* and *monte Porcio*, till it brings you to *Fraſcati*. Theſe tufo-hills run afterwards in an uninterrupted chain to *Marino*, *Albano*, *Genſano*, *Veletri*, and bending behind *monti dell' Ariano*, they run back to *monte Algido*. Within this circle lay incloſed the whole extent of *monte Cavo* or *Albano*, its adjacent volcanic hills, and *Lago di Nemi* and *di Caſtello*. Accordingly the whole country is volcanic, as will plainly appear hereafter. *Ameti's* map of *Latium Parte* 1. *maritima* is very accurate.

From *Fraſcati* the road goes over *Rocca di Papa*, a ſmall place ſituated on a high rock of lava, and brings you to *monte Cavo* or *monte Albano*. There are on both ſides of this hill old roads paved with lava.

Monte Albano or *monte Cavo* conſiſts of volcanic productions, which are the following.

1. Grey or yellow brown tufo, with ſmall white farinaceous ſherl-cryſtals.

2. Red puzzolana with red pumice-ſtones.

3. Greeniſh-grey ferruminated aſhes, with black ſherl-lamelles, white garnet-like ſherls, and ſmall pumice-ſtones. This tufo is called *Piperino* *.

4. Spungy and compact black lava without and with white garnet-ſherls.

Theſe volcanic productions alternate without any order but that which accident gave them in the former eruptions. The lava, as well as the Piperino, contain calcined fragments of limeſtone; and, on the road up the hill, appear plenty of large limeſtone fragments, of ſherl, of lamellated ſherl, and of mica; which, in former times, have been thrown out by ſubterraneous force. This ſhews, that the volcanic productions of *monte Albano* and of *Veſuvius* are exactly the ſame. The view from its top is very extenſive and agreeable; comprehending the beautiful plains and the ſea towards Terracina, Rome, the Tiber, and its wide-ſtretching claſſical neighbourhood. At the foot of *monte Albano* you ſee *Lago di Nemi*, and *Lago di Caſtello*, or *d'Albano*,

* In the Piperino of *monte Albano* I have obſerved fragments of white quartz, with great cubic black ſherl-glimmer or horn-blende, which entirely reſembled the antique *Granito nero*, except that by heat it had been cracked.

both

both round or rather oval, separated by high ground two Italian miles in extent. They have been undoubtedly funnels of this volcano, and *monte Cavo* or *Albano*, which are deſtitute of funnels; ſeveral other lava and cinericious hills are but remaining parts of their former high-towering periphery after it ſunk, and produced the before-mentioned lakes.

Monte Albano is about twelve Italian miles diſtant from Rome. Its periphery is about ſixteen Italian miles. It is like Veſuvius ſeparated into two parts in the *montes Tuſculani* and *montes Albani*.

Montes Tuſculani are to *monte Albano* in the ſame proportion as monte Somma to Veſuvius.

Montes Albani have the two higheſt tops, called 1. *Monte Algido*, mentioned by Horace; and 2. *Monte Cavo*, or properly *Monte Albano*. On this hill are the ruins of an ancient round temple of Jupiter Latialis, built with volcanic tufo, mixed with white garnet-like ſherl. Towards the Lago d'Albano I ſaw on its ſides, as in many other parts of this country, plenty of *Narciſſus-poeticus*.

The volcanic and Piperino hills around *monte Cavo* are bare and deſtitute of wood as the hill of the Camaldules near Veſuvius. One of theſe hills is called *monte Porcio*, another *monte Compatro*, a third ſeparated from the chief mountain *monte*

Colonna (columen); *Civita Lavinia* or *Lanuvium*, is ſituated on a fourth.

Monte Cavo is entirely iſolate. At its foot are *Lago d'Albano*, or *di Caſtell Gandolfo*, and *Lago di Nemi (Lacus Dianæ, Speculum Dianæ*, or *Lacus Aricinus)*, on which the Ancients are ſaid to have had floating gardens, built on boats. Lately they have diſcovered here leaden pipes, marked with the name of Tiberius. At one end of this lake is a flat ground planted with fruit-trees; and near the city of Nemi are ſome mills, turned by ſprings, one of which is ſaid to be occaſioned by the tears of the nymph Egeria afflicted by her beloved Numa's death.

On the *Lake d'Albano* lies *Caſtell' Gandolfo*, *Palazzuolo*, *Albano*, a ſmall city. *Albanum Suetonii in vita Neronis.*

On the *Lago di Nime* lies *Nemi*, and over-againſt on the other ſide *Genſano (Cinthyanum)*, and near by a monaſtery of capucins. The country admirable.

Veletri is at the foot of *monte Albano* towards the Pomptinian fens. *Marino*, *Fraſcati*, *Rocca di Papa*, are towards Rome.

Rocca priora is on the top of the Tuſculan-hills over-againſt the top of *monte Algido.*

Riccia or *Aricia* is between *Albano* and *Genſano.*

The aſhes of the Albano Volcano have been ſpread up to *Poli*, a place which lies eight Italian miles in the Apennines.

At the foot of *monte Colonna* is *Lago di Regilla*, which has been an old volcanic crater.

Lago di Caſtiglione has been probably of the ſame nature, and would have been on this account the remoteſt crater of the Alban mountains.

The quarries of the Piperino, employed at Rome in buildings and ſculpture, are near *Marino*. I have deſcribed already the nature of this volcanic ſtone.

The quarries of the black compact lava of the Alban volcano, which is called *Selce*, are near *Albano alle Fratocchie*, and *alla Cava de Selci*. It is employed at Rome, and the adjacent places, in the pavings of the roads and ſtreets; in ſtatues; and in reſtorations of old mutilated oriental baſalt-ſtatues: in which caſe, this lava, or ſelce, is called *occidental baſaltes*. I have had an opportunity to be convinced of it. The uſual garnet-like white cryſtallizations are now and then found in it; but then they do not employ it. The black ſherl and the green and yellow pebbles of the Veſuvian lavas are likewiſe found in this.

Dionyſius of Halicarnaſſus tells us, that a king of Alba was ſwallowed up with his palace in the Lago d'Albano. And Livy, lib. i. has the fol-

lowing paſſage. " Nunciatum eſt regi patribuſque " in monte Albano lapides pluiſſe. Miſſis ad " viſendum id prodigium in conſpectu cecidere " lapides. Viſi etiam audire vocem ingentem ex " ſummi cacuminis luco." This lucus was at the top of monte Cavo.

During the ſiege of *Veja*, 398 before the Chriſtian æra, the lake of Albano overflowed the country, and cauſed a pernicious inundation. The Oracle of Delphi anſwered, upon demand, that a draining ought to be made. If they did ſo, it cannot be the canal, which is ſtill to be ſeen, ſince it drains the lake under the level, which was requiſite to water by that lake the fields at *Alba*, as they uſed to do according to *Dionyſius* of *Halicarnaſſus*, who lived under Auguſtus. Therefore the preſent canal is rather to be aſcribed to the ſucceſſors of Auguſtus. The depth of *Lago d' Albano* is ſaid to be three hundred and ſixty feet. There is plenty of large eels in it, and the fiſhery rented by a fiſherman. Near it are the remains of a temple of Diana. Another belonging to that goddeſs was formerly near *Lago di Nemi*.

I went from *monte Cavo* by *Genſano* to *Rezia* or *Riccia*, in former times *Aricia*; and returned thence by a fine country over the gentle ſloping of a volcanic hill; which, in an amphitheatrical form, incloſes a part of the plain over *Albano*, *Marino*, and

and a flat country of volcanic aſhes and hills, to *Rome*.

The ground about *Rome* is generally of that nature; however, there are ſome calcareous hills, conſiſting of white, yellow, or grey porous lime- or marl-ſtone, with plenty of ſea-ſhells. Such are the hills which offer on the road of *Porta del Popolo*, beyond the vineyard *Papa Giulia*, as far as *Aqua Acetoſa*; ſuch are, on the other ſide, the hills of the *Vatican* and *monte Mario*. I had no opportunity to obſerve the extent and run of theſe calcareous hills on the other ſide of Rome; but the before-mentioned may be eaſily ſurveyed from *Trinità di monte* and the *villa Medici*. Some of the ſeven Roman hills might, upon examination, be found calcareous.

Before *Porta del Popolo*, near *Papa Giulia*, the hills conſiſt of grey, yellowiſh, looſe calcareous earth, mixed with lumps of yellow-browniſh calcareous *oſteocolla*, produced by incruſtated roots and plant-ſtems. Near *Aqua Acetoſa* this calcareous mould is coagulated into a hard lime-ſtone tufo. *Monte Mario* is grey-yellow calcareous earth, mixed with ſome clay and a ſpecies of marl. Here appears above ground a large ſtratum of looſe great oyſter-ſhells, of ſmall bivalves, univalves, balani, and echini, covered by red-brown looſe ſea ſand. This is beſt obſerved in going by the com-

mon

mon road to the *villa Mellini*, and *villa Madama*, on *monte Mario*, since it is deeply cut into this hill, which in greater depth may probably contain many more such marine strata.

This description of *monte Mario*, and of other like hills, seems to support the inference, that they have been immediately deposited by the sea, and that the inclosed osteocolla-lumps have been produced by the soaking and filtering of waters. The compact limestones in the Apennines are separated from these hills by the valley between Rome and Tivoli, which is covered by volcanic ashes. Hence we may conclude, with some probability, that the Apennine limestone beds are continuing under the volcanic productions of the valley towards the Roman calcareous hills; which, on this account, are in the same proportion to the Apennines, as the Vicentine *colles tertiarii* are to their *montes secundarii*. The volcanos therefore have forced here their way through the inferior limestone, and spread their ashes over the lower calcareous plains, leaving the higher hills uncovered and bare. This opinion is strongly countenanced by the frequent limestone-fragments in the *Piperinos*, *lavas*, and *yellow-brownish tufos*, by their effervescence with the acids, and by the loose separated straying limestones on *monte Albano*. The volcanic productions have been afterward covered in many places, as near *Tivoli*, with

with new ſtrata of calcareous tophus, produced by the calcareous waters of the Apennines, or the overflowings of the tophaceous *Lago de' Tartari* and *Lago de' Bagni*.

Theſe few calcareous hills excepted, the ſoil about Rome is volcanic, and covered with yellow-brown volcanic aſhes. Commonly they are looſe, and employed as puzzolana. The greater part is dug *alla Porta di S. Paolo* near Rome, and by the Tiber ſhipped to *Civita Vecchia*; whence it is exported into ſeveral parts of Europe. In *monte Verde* near Rome, *alla Porta Porteſe*, to the right of the road, theſe aſhes are ferruminated into a tufo, which is employed at Rome in maſonry and buildings. The varieties of *tufo* in the different beds of the hill are as follows.

1. Grey-yellow margaceous tufo, ſprinkled with white farinaceous round ſpots of calcined or mouldered garnet-like ſherls. This tufo is ſomewhat calcareous as fermenting with acids; but it is likewiſe argillaceous, which ſeems to be owing to an adventitious mixture, or to a ſort of diſſolution by the air. The white farinaceous ſpots are leſs affected by acids.

2. Grey-brown, looſe, friable tufo, with plenty of little white round ſpots as the before deſcribed; ſomething fermenting with acids, unfit for buildings.

3. A

3. A deep-brown unſpotted tufo, unmixed, except with ſome lamelles of black-green ſherl glimmer.

4. The common building-tufo, compoſed of fragments of grey-yellow brown, greeniſh and deep-brown tufo, black ſherl-grains, and white calcined farinaceous garnet-like cryſtals or round ſpots, more or leſs fermenting with acids. The whole mixture of this tufo ſomewhat affected by aqua fortis. Some years ago they found in this *monte-verde tufo* a large bone, which was conſidered as a tooth of a cacholong, and is deſcribed by *P. Jacquier* in an Italian magazine; but its length of four or five feet did not agree with that denomination. It was rather a bone or tuſk of an elephant, brought there by accident, and covered in aſhes by a poſterior eruption of the adjacent volcano. The round pebbles ſometimes incloſed in this tufo may have been brought there by ſimilar accidents, or rolled from higher grounds; which is the more probable, as near *Fiumicino* there are hills of ferruminated pebbles or a coarſe *breccia*.

LET.

LETTER XV.

Rome, April 18, 1772.

SOON after I ſent my laſt, I made an excurſion to Civita Vecchia and the alum-works at Tolfa. I had the agreeable and inſtructing company of Mr. Guettard, of Baron de Geer, and of Mr. Corea. However, my curioſity has not been compleatly ſatisfied, ſince the bad rainy and ſtormy weather not only made our obſervations very difficult, but likewiſe hindered me from examining the country about *Tolfa*. While I let you know what I had leiſure to obſerve, I tell you the blanks, which you will pleaſe to fill up.

As ſoon as we had paſſed the *Porta fabrica* at Rome, which is near S. Peter's and the Vatican, we obſerved the continuation of the calcareous hills on which the Vatican is ſituated. Afterwards the road was covered with brown ſea ſand, which on both ſides made ſmall hills decked with brown-yellow volcanic aſhes. Near the inn *Monterone*, half way to *Civita Vecchia*, I ſaw under the mould

mould a calcareous tophus, which changed afterwards into a true limeſtone. Then ſucceeded again ſand-ſtone, which laſted but a ſhort while, and was followed by the limeſtone till near *Civita Vecchia*; where, near the ſea-ſhore, it grew very ſhivery, argillaceous, and finally a true marl. The whole country, from Rome to Civita Vecchia, is flat, and ſeems to have been accumulated by marine alluvions.

From *Civita Vecchia* to the alum quarries near *Tolfa* is eleven Italian miles, the road continually aſcending through woody countries, over the following ſtones.

1. Near *Civita Vecchia*, white, grey, and reddiſh *marl-ſlate*.

2. White-grey limeſtone.

3. Blue, grey, or perlaceous marl-ſlate.

4. Again limeſtone.

5. An argillaceous, either black, grey, or blue-grey ſlate, in ſome parts penetrated with iron, whence it was become black and hard.

6. White or reddiſh compact marl, more or leſs calcareous; and, finally,

7. White, high, and argillaceous hills, compact, with ſcarce any viſible horizontal beddings. Theſe rocks yield the Roman alum.

Hence it appears, that the whole country from *Civita Vecchia* to *Tolfa* is generally calcareous, only

only more or less mixed with clay. The argillaceous slate, N° 5. (and perhaps similar hills on both sides of the way) is entirely destitute of any calcareous mixture. So are likewise the alum-rocks, N° 7, which contain so trifling a quantity of lime, that it cannot be considered as a substantial part; joined to the acid of vitriol it precipitates as *selenite*. I could not observe the position of these seven different sorts of stone; whether their difference is owing only to a different mixture in the surface; or, whether the argillaceous slate, and the white alum-rock, as in other parts of Italy, be inferior to the superincumbent calcareous hills; and but in some places appear above ground, either bare and unmixed, or as marl, more or less calcareous. This last I hold to be most probable, as observed in many other parts of Italy; but, as the bad weather and shortness of time did not permit me any closer examination of this country, I could not ascertain it, and leave it therefore to your future enquiries.

In argillaceous slate hills, mentioned N° 5, are to the right, and at some distance old deserted lead, copper, and iron-mines; and probably the celebrated quartz-crystallizations, going under the name of Tolfa-diamonds, may be found in these mines; but as the alum-rocks, N° 7, offer likewise quartz-fissures, I cannot be positive about it.

Ameti's

Ameti's geographical map places hereabout antimonial mines, which I have been assured to be fictitious. I got at *Civita Vecchia* some minerals of these parts; consisting of yellow copper-pyrites with green fluor, blende, blue azure-copper-ore, and malachites in argillaceous slate.

The alum-hills, N°. 7. are very high shining white rocks, separated by a long valley and large excavations, which are made in the following manner: The workmen descend by ropes to the steep rocks; thus suspended, they bore blasting-holes, fill them with cartridges, free the rocks which by former blastings are loosened, and then are pulled up again. The firing of the powder is done by dry branches and leaves, which experience has taught them to throw from on high to any place below.

The alum-rock is white-grey or chalk-white; extremely compact and remarkably hard. Scraped with a knife it yields an argillaceous powder, which does not ferment with any acid, since penetrated by the vitriolic acid, and being composed of an argillaceous substance. There are some blueish-grey shivery pieces, which are rejected as unfit, and probably are remains of the natural argillaceous stone before it was sufficiently imbibed and whitened by the vitriolic acid. In some cracks appears a chalk-white ductile clay. Some pieces

are blueish-grey with white spots, produced by the acid. These are much resembling the half-dissolved black lava in *Solfatara* with white garnet-like sherls; with this difference, that in Solfatara the subterraneous acid worked upon lava, and here upon an argillaceous blueish stone. The acid seems in this place likewise to be produced by subterraneous steams, which, penetrating the argillaceous stones, changed them into alum-ore. I could not ascertain whether there be near Tolfa ancient volcanos; but I saw lava-fragments in the wall under the boiling-pans; and therefore they cannot be far distant.

By all this it appears, that the aluminous rock at Tolfa is an indurated clay, having imbibed and been whitened by a vitriolic acid, and contains some scarce calcareous particles, which in the alum-manufactories precipitate in the wooden rills or troughs under the form of selenites. It is a compact and sound rock, neither stratified nor shivery and slaty. Some nearly perpendicular white-grey quartz-veins, three or four inches large, cross it from top to bottom: and in some places appears in the midst of the white rock a red mixture, as it were of a colcothar vitrioli, or crocus martis, or spotted pieces, which resemble red and white marbled soap.

The blaſted ſtones are calcined in furnaces, which have an inverted conical form. They are in the open fields cloſe together, ſurrounded and ſeparated by a covering of turf and mould. The upper diameter is about eight feet. They are filled at the bottom with wood, and then heaped with alum-ſtone, which appears above the furnaces as an accumulated cone, nine or ten feet high, which is nearly anſwering to the depth of the furnace. Then fire is ſet to the wood by a ſquare vent near the bottom, and the whole is burnt down in about three hours time; which is, as they told me, the requiſite time for burning: after which the heated ſtones are carried to the boiling-houſe, diſtant about one Italian mile from the quarries. Here they are put into large pits, or ſquare wooden reſervoirs, half ſunk into the ground; where they are ſteeped in a convenient quantity of water, which, after ſufficient diſſolution of the alum, is by troughs conveyed into the alum-houſe, and in large ſquare wooden ſettlers, that the dregs may ſettle at the bottom. This done, the clear lixivium is poured into braſs pans, and after ſufficient boiling conveyed into wooden coolers, on whoſe ſides the alum cryſtallizes white and reddiſh. Before the inſpiſſated brine be conveyed into the cooler, they ſtop it for ſome time in the troughs, in order to facilitate the precipita-

tion of a reddiſh ſelenite; and in the boiling they mix in the liquor ſome lime * and urine.

The ſupports of the pans are made of a grey lava with large white cryſtalline ſherl-priſms, whoſe quantity exceeds the maſs of the ferruminating lava. It is found, as they told me, in large looſe pieces, at nine or ten miles diſtance from *Tolfa*; and it reſembles much the lava of a volcanic hill, called *S. Fiora* in Toſcana, which I have ſeen, and ſhall deſcribe in my following Letters.

The Tolfa alum-works are ſaid to have been diſcovered in former times by a man, who, having been long time a ſlave in Turkey, and worked there in ſome alum-works, gueſſed by the *Ilex Aquifolium*, common about *Tolfa*, that there muſt be aluminous works in the neighbourhood. But this ſhrub is found in many places where no alum is to be had at all.

Monſignor *Borgia* at Rome, who had the goodneſs to provide us with recommendations to Civita Vecchia and Tolfa, and who, notwithſtanding his troubleſome inſpection of the *Collegium de propaganda fide*, preſerves a good taſte for every ſcience, has made in his travels through the Ro-

* If this be the caſe, the ſelenite is in no reſpect a ſubſtantial part of the Tolfa alum-ſtone, as the author ſeems inclined to ſuppoſe.

man dominions several historical and œconomical remarks on *Tolfa*, and the other mines and productions of the Roman State. He had the politeness to promise a copy of them to Mr. *Guettard*, who intends to give them to the publick.

I gathered some sea-plants about Civita Vecchia. On the Roman road and about *Tolfa*, I observed the *Fraxinus Ornus*, from which, being in plenty in that place, they gather manna, a sweet officinal juice, distilling from openings cut in the bark of the trees. On *monte Gennaro* in the Apennines near *Tivoli*, and at *Arienza* near Naples, they gather it likewise; but the greatest part comes from Calabria.

LET-

LETTER XVI.

Rome, April 26, 1772.

THIS being my laſt letter from Rome, I have kept for it the account of the antique ſtones, which are the materials of the immortal works of Art and Antiquity, and the chief ornaments of the Roman and Italian churches and palaces. I have ſpared no pains to obſerve a great variety of them; and have repeatedly examined the churches, palaces, and collections of antiquities, eſpecially thoſe in the capitol, and in the villa Albani. I have alſo bought from the marble-cutters *(Marmaji oſia Scarpellini)* a great variety; but the ignorance and avidity of theſe people makes caution neceſſary, to avoid purchaſing the ſame ſpecies under different names, and not to depend upon thoſe denominations but in which they generally agree, or which are given by the moſt ſkilful. Thus hope to be pretty well acquainted with the antique marbles, and their odd and ſingular names, without which they are not to be underſtood by

the artists. The modern marbles employed at Rome shall be noticed in those places where they are dug out. Though the description of the colours be very difficult and of little use, since the colours only make varieties; yet a Naturalist should, by a due regard for the finer arts, be as nearly as possible acquainted with them, and Antiquaries should not neglect them. Practice, and frequent examination, teach best how to distinguish the different species; which may be obtained by small samples, sold at *Rome*, *Naples*, and *Florence*. I cannot advise the purchasing of what they call a whole set or studio, because that is buying many indifferent samples, and many false denominations; unless a Naturalist should choose to purchase different studia in different places, and thence to form a compleat one, by examining the justness of the names, and by throwing away what was indifferent in itself, or went under false and improper names. I hope my list of the different species and varieties of Porphyry, Granites, and Basaltes, will be as compleat and exact as possible. But it is difficult and expensive to get at their samples, and at the other pretended *Pietre dure*, such as jaspers, agates, cornelians, &c.

The before-mentioned antique marbles and stones may be ranked under the following genera:

Marble,

Marble, Lumachella, Alabaſter, Jaſper, Breccia, Porphyry, Granites, Baſaltes.

I. *Antique Marbles.*

Marmo Africano, purple, white ſpotted with black intervals, which ſeem to be argillaceous. A like ſpecies is dug at *Seravezza*; therefore called Africano, and employed inſtead of the antique.

Africano fiorito, white, purple and yellow ſpotted; the ſpots like flames, and the maſs or intervals blackiſh, of an argillaceous nature.

Arlechino, or *di Seme Santo*, dark red with ſmall triangular white ſpots—*Arlechino*, on account of its many ſpots; and *Seme Santo*, on account of their likeneſs, with white ſeeds, and its being frequently employed in holy places. Now and then called *Breccia di Seme Santo*, but that is an abuſe of the word; it ſhould rather be called *Broccatello*.

M. Bigio, grey antique marbles.

M. Breccia darata has great yellow ſpots upon a red ground, in which now and then appears ſome white. The Italians call this and other variegated ſpotted marbles *Breccia*; though this be the proper denomination of ſeparated different ſtones ferruminated into a common maſs. Spotted marbles are properly to be called *Broccatello*; but this word is ſeldom employed.

Breccia di Seme Santo di Sette baſi. See Seme Santo and Arlechino.

Breccia Pavonazza reſembling a true Breccia, compoſed of white roundiſh calcareous cryſtallizations in a blackiſh ground. I ſaw it in the decorations of the Muſeum Clementinum; dubious whether antique or modern Seravezza marble.

Brocatello. See *Breccia dorata.*

Brocatellone, red and white ſpotted, differing from the *Roſſo annulato.*

M. Cannello, cinnamon brown.

Cipolazzo, white and violet.

Cipolino is a white Greek marble, croſſed by greeniſh gloſſy micaceous ſtripes, ferruminated with clay, and for that reaſon to be conſidered as micaceous ſlate. The white colour is leſs clear, as in the Palombino. This marble has been, perhaps, dug from the undermoſt marble ſtratum, impoſed on argillaceous ſlate; it is commonly employed in columns and the outſides of churches and palaces.

M. Cotonello, white and red coloured; as minium or red lead. The name very obſcure.

M. Fior di Perſico, or *Perſechino,* white and grey, with crimſon or bloſſom coloured ſpots.

Fiorito, red and white ſpotted; the ſpots like flames. But there are many other marbles called *Fioriti,* on account of their flame-like or ſtripy

ſpots, though differing in colour. See *Porta ſanta fiorita.*

M. Giallo, yellow; uſed for altars, tables, &c.

Giallo annulato, yellow and black, ſpotted or ringled, reſembling the *Brocatello di Siena.*

Giallo brecciato, yellow, with dark yellow ſpots.

Giallo e nero, yellow and black ſpotted, differing from the Giallo annulato by the bigneſs of the ſpots.

Giallo pagliocco, ſtraw yellow.

Nero, black. Some buſts and pedeſtals in the capitol and the villa Albani, together with the ornaments of ſome altars, are of this marble.

Ner 'e bianco antico, white and black ſtriped.

Occhio di pernice, blackiſh and blackiſh red with white ſpots.

Occhio di pavone, red, white, and yellow ſpotted.

Palombino, white compact, neither ſcaly nor cryſtalline.

Paragone, black; may ſerve as touch-ſtone. The *Paragone di Bergamo* entirely ſimilar to the antique.

Paro antico, beautifully milk white, extremely compact, though cryſtalline or ſcaly. The *Carrara* marble is very like it, but leſs compact.

Pavonazzo, white with red ſtripes. See *Breccia pavonazza.*

Pecorello or *Pecorella*, red and white ſpots with white ringlets.

Porta

Porta ſanta fiorita, white or grey with purple ſpots, formed like flames; called *Porta ſanta* becauſe employed in the Porta ſanta at *S. Pieter's*.

Porta ſanta non fiorita, red, white ſpotted.

Perſechino. See *Fior de Perſico*.

Purichiello, red and white.

Rezziato, white-yellow ſpotted.

Roſſo, dark red; ſcarce, and dear.

Roſſo brecciato, browniſh with red ſpots.

Roſſo annulato, red-white ſpotted.

Di Seme Santo. See *Arlechino*.

Seme Santo di Sette Baſi, or *Breccia di Seme Santo*, &c. purple-white ſpotted; not to be confounded with the *Arlechino*.

Serpentelo, *Serpetiela*, or *Serparielo*, white red ſtriped.

Sette baſi, white-red veined.

Statuario, white, reſembling the Parian, and perhaps the ſame ſpecies; leſs milky and opaque; ſemipellucid, though in large pieces. I remember to have ſeen at Venice, and other places in Lombardy, ſuch tranſparent columns.

Vendurino, red and white.

Verd' antico, green and white with black greeniſh ſpots.

Verde pagliocco, greeniſh yellow.

Theſe are the varieties of the antique marbles, which, with much pains, I have been acquainted with.

with. They are truely antique, as being every day dug out of the ruins of old Roman buildings. I have not at hand the catalogue of *Produzzioni naturali, che ſi ritrovano nel Muſeo* Ginanni *in Ravenna*. Lucca, 1762. 4to. wherein many antique and modern marbles have been deſcribed: I have not *D'Argenville's Oryctographia*; therefore I deſire you to compare their liſts with mine, ſince I may have ſlipt ſome varieties. *Blaſius Caryophilus de antiquis marmoribus*, Viennæ, 1738, 4to. is a valuable learned performance; but hardly any of its deſcriptions are to be traced out, as the ancient denominations of the Claſſics are entirely different from the modern ones. They commonly employ at Rome much *Broccatello di Spagna*, French and Flanders marbles, and Florentine marble; which, on account of its landſcape figures, is called Marmo paeſino. *Dendritical marble* is called *Alberino*, commonly ſet in Moſaic-tables. Petrified corals, lithophytes, and madrepores, employed to the ſame purpoſe and in ſnuff-boxes, are called *pietre ſtellarie*. But generally theſe denominations are independent of any rule, occaſioned only by the fancy of the artiſts and journeymen, which often is very capricious and whimſical; ſome, for example, called a red, yellow, and brown variegated Sicilian marble, *Diaſpro moderno di Sicilia*, though on account of hardneſs, colour, and nature, entirely

tirely different from the Sicilian jaſper. Cubic pyrites or marcaſite-dice went under the name of *pietra quadrata*.

II. *Lumachella*.

Is limeſtone or marble, filled with petrifactions of ſhells. I have ſeen ſeveral varieties at Rome, which paſſing for antique ſold very dear; ſuch as,

1. Grey-brown lumachella, with white tranſparent agate, like veins.

2. Ditto, with roſe-coloured ſtripes; beautiful and ſcarce.

3. Ditto, with ſmaller ſhells, called *caſtracana*; extremely dear.

4. Yellow-browniſh lumachella, with plenty of ſmall black ſhells. Beſides them they employ the lumachella of Sicily and Calabria abruzza.

III. *Oriental Alabaſter*.

1. White tranſparent, now and then with thin parallel milk-white ſtripes.

2. White opaque, milk-coloured.

3. *Alabaſtro Tartarucato*, brown, like turtle-ſhell, ſcarce ſemipellucid, ſometimes veined or watered,

watered, and then extremely beautiful; called likewiſe *pietra puruchina*. I do not know for what reaſon.

4. *Alabaſtro fiorito*, brown and white, in alternating parallel ſtripes, which are either waving or angulating. Sometimes with ſmall iron-dendrites, as in ſome pedeſtals in the *villa Albani*.

IV. *Jaſper.*

1. *Diaſpro Sanguigno oſia Heliotropio* is a greeniſh oriental jaſper, with ſmall blood-red ſpots.

2. *Diaſpro roſſo* is not commonly antique, but commonly found at *Barga* in Toſcana, or in *Sicily*.

3. *Diaſpro giallo*, yellowiſh-brown, veined with thin green and white waves.

4. *Diaſpro fiorito reticellato* is white tranſparent agate-like, with dark-red ſpots and ſtripes; the ſpots incloſed into a white opaque milky or yellow line. At Mondragone at *Froſcati*, and elſewhere, magnificent tables, compoſed of this and other hard ſtones. Antique, and very ſcarce.

There is a ſimilar *Diaſpro fiorito* from *Sicily*, *Spain*, and *Conſtantinople*.

V. *Breccia*

V. *Breccia silicea.*

I speak here only of the flint, or horn-stone Breccia, which is a true *pudding-stone.* The calcareous ones belong to the marbles.

1. *Pietra fruticolosa*, or *frutiliosa orientale*, an ancient pudding-stone; consisting of yellow and red roundish pebbles inclosed with black iron dendrites. I saw only a single specimen of that kind.

2. *Breccia verde d'Egitto*, ferruminated from darker and higher, round and undetermined green fragments, which seemed to be terraceous, taking no remarkable polish; however, extremely hard, and agreeable on account of the fine colours. Large Granite pieces inclosed now and then into its mixture. In the villa *Albani* is kept a great vase, composed of fragments of this Breccia, large blocks not being to be had; though the Ancients, as appears by fragments and ruins, had large columns of this Breccia.

VI. *Porphyry.*

1. *Porfido rosso*, dark-red, with white oblong spots; most commonly employed in Italy. The ground-

ground colour is dyed in different degrees. There are ſome almoſt entirely black. The ſpots are commonly ſmall and oblong; ſometimes larger, and then either oblong, that is, parallelopiped, or angulated irregular. They are opaque, milky, and compact feld-ſpath, but of a ſherl-nature, as appears by their parallelopiped form, and other external marks; hence, they ſeem to me to be a middle ſpecies of feld-ſpath and ſherl. The real difference between ſherl, feld-ſpath, quartz, and other flint, and garnet-ſpecies, is but very ſmall, merely depending on ſome admixtures *(Cronſted. Mineralogy)*. Sometimes there offer in the red Porphyry blunted pieces of another porphyry-ſpecies, with whiter ground and larger ſpots. Theſe adventitious pieces ſuppoſe the incloſing maſs to have been ductile, as that of the Breccia. This may be obſerved on ſome Porphyry columns on the out-ſide of *S. Marco* at *Venice*. There appear likewiſe in it ſome thin black ſherl-feathers, as on the pedeſtal of the Diana triformis, in the capitol at Rome.

2. *Porfido nero*, black-white ſpotted. There are two varieties.

a. Entirely black, with ſmall oblong white Porphyry-ſpots; the colour excepted entirely reſembling the red Porpyhry. Of that kind there are two

two large fine columns in the church *delle tre fontane alla Porta di S. Paolo.*

b. *Serpentino nero antico*, black, with large white parallelopiped spots, similar to those in the *Serpentino verd' antico*; which, the colour excepted, is entirely resembling to this. A fine column of that kind is in the church *di S. Praßede* at Rome. I saw at Florence in Mr. *Targioni Tozzetti's* collection some Tuscan lavas; which, on account of their parallelopiped white sherl-spots, resembled entirely to this *Serpentino ner' antico*. Mr. *Cronsted* (*Mineral.* § 259.) speaks of a *Serpentino antico*, as not being a Porphyry, but an Ophites, consisting of white marble with black steatit-crystallizations; but I did not see or hear at Rome of such an antique stone.

3. *Porfido bruno*, brown, with oblong greenish spots, entirely resembling the *Serpentino verd' antico*; the brown colour likely owing to iron-ocher. There are two varieties.

a. Liver-brown, and fair green spots. In the collection of Mr. *Targioni Tozzetti* at *Florence*; antique.

b. Black-brown, with spots half black and half green. Count *Cronstedt* had bought a specimen of that kind.

4. *Porfido verde.* There are many species; the

lesser

leſſer part diſtinguiſhed by names; wherefore I ſhall attempt their deſcriptions.

A. *Serpentino verd' antico* found in large blocks and lumps near *Oſtia*, the old harbour where the Egyptian ſhips unloaded. The ground green; the ſpots oblong or parallelopiped, feld-ſpath or ſherl; more or leſs green. The colour perhaps owing to copper ochre. In the ſubſtance now and then holes or bladders like thoſe which air forms in melted materials; but white tranſparent flint, or agate-ſpots, of an undetermined or roundiſh figure, are common in it. I have ſeen the following varieties.

a. Dark-green, with fair green ſpots; common.

b. Dark-green, with white ſpots.

c. Dark-green, with black ſpots.

d. Fair-green, or green-yelloviſh, with black ſpots.

B. *Porfido verde propriamente coſi chiamato*; dark-green, nearly black, with different ſhadowings or graſs-green. The maſs never quite ſo hard as jaſper, but often reſembling trapp, and to be ſcraped with a knife. The ſpots white, but commonly undetermined. The following varieties have offered themſelves to me.

α. Green porphyry, jaſper-like dark or black-green, with diſtinct oblong ſherl-ſpots, larger than

in the black ſpecies 2 *a.* and ſmaller than in the *Serpentino nero antico,* (2 *b.*)

β. Green porphyry, dark-green jaſper-like, with ſmall roundiſh and oblong white ſpots, ſimilar to the red porphyry except in colour.

γ. Green porphyry, trap-like and dark-green, with undetermined large white quartz ſpots; theſe ſpots often ſo common that it may rather be called a white ſpecies; now and then the dark trapp-green cryſtallized into ſherl-cryſtals, and then much reſembling Granites, which have ſherl inſtead of mica. See the Granites 3, 4.

δ. Green porphyry, with trap-like dark-green ſmall oblong, compact ſherl, in white ſpots, commonly irregular, and twiſted in maſſes like ſmall worms; called *Porfido verde fiorito.*

ε. Light-green porphyry, trap-like, with oblong determined and regular white porphyry ſpots and ſmall black ſherl-cryſtals. There is a column of it at the Baptiſtery in the cathedral church at Siena, among ſeveral columns of Granite and Granitello.

VII. *Oriental Granite.*

1. *Granito roſſo* conſiſts in white quartz, large pieces of red feld-ſpath and black mica. There is a violet

a violet ſpecies on the iſland of *Elba*. *Pococke* gives ſome account of the Granite-quarries in Egypt. Europe produces Granite in almoſt every country, in the iſlands Corſica, Sardinia, Elba, in Toſcana, in the Saneſe, in Switzerland, and the higheſt Alps, in the higheſt mountains of the Hartz, in Bohemia, in Saxony, in the Carpathian hills, in Sweden, Normandy, and Lapland. Theſe European Granites are in no reſpect differing from the pretended oriental ones; there are red and grey ſorts, and they would furniſh as large maſſes as the Egyptian obeliſks, if we did not grudge time and money.

2. *Granito Grigio* or *Bigio*, grey; conſiſts in white tranſparent or milky tranſparent quartz, white feld-ſpath and black mica. If all theſe mixtured ſtones be ſmall, it is called *Granitello*. The quartz being commonly the greater part, and now and then, but ſcarcely, mixed with feld-ſpath; which commonly appears in cubic lumps, this ſort of ſtone wants an exact examination. If the feld-ſpath be entirely wanting, the mixture of quartz and glimmer is properly called *Hornberg*, *Hornfels*, or *Geſtell-Stein*; and it is flaty or ſhivery if the mica exceed the quantity of quartz. But the ſtone-cutters are not ſo nice in the denominations, ranking even the *Geſtell-Stein* among the grey Granites. There is a ſpecies of the grey large ſpotted

Granite, in which the feld-ſpath forms large white parallelopiped ſpots in the length of a finger, and in the form of the ſpots in *Serpentino verd' antico*. The compoſition of theſe ſpots is of oblique cubic lamelles; and they ſeem to be a middle ſubſtance of ſherl and feld-ſpath. Such Granites is the *Colonna alle piazza di S. Felicità* at Florence. In ſome other Granite and Granitello-columns in the outſide of the royal palace at *Naples*, and at *Salerno*, I have obſerved large black ſpots, occaſioned by a cloſer mixture of mica. But at Florence I ſaw a grey Granite-colonne, with black ſpots, that entirely reſembled *Porfido Serpentino ner' antico*, and ſeemed to have been as pebbles incloſed in the ſtill ductile maſs of the Granit. Finally, there are grey Granites, which have ſherl-lamelles or ſherl-mica inſtead of the common mica.

3. *Granito nero*, or rather *ner 'e bianco*, conſiſts of white quartz, ſome ſcarce or even no feld-ſpath-particles, and large oblong and black ſherl-ſpots, which are here in the place of the mica. Commonly they have a columnar parallelopiped form, are cubic where broken, and thus are a ſpecies of Horn-blende. Of this Granite is a column in S. Praſſede at Rome, to the left of the entrance to the chapel; where they keep the column on which Chriſt is ſaid to have been flagellated. (*Mercurio errante di Roma*, p. 235.) If the ſherl ſpots be

ſo

ſo common, that the chief colour or ground ſeem black, it is called *Granito ner'e bianco a macchie grandi*; and ſuch is the column kept in S. Praſſede, on which Chriſt ſuffered flagellation.

4. *Granito verde*, green Granite, conſiſts of white quartz, ſcarce feld-ſpath particles, and large oblong ſherl-ſpots, as the former, *n.* 3. except that the white ground appears light-green in the ſurface; which makes this variety of Granites much like the above green porphyry (4. B. *γ.*) whoſe green trap-ground is cryſtallized like ſherl, and whoſe white ſpots are large. The difference is, that the green Granite appears in the white quartz, and that in the porphyry it appears in the ſherl-cryſtallizations. A column of green Granites is in the *villa Pamphili* at Rome.

The ſtone-cutters and dealers call the antique Granite Oriental, or. *d'Egitto*; and the European Occidental. On the ſame footing, the antique or Egyptian baſaltes goes under the name of Oriental. It is the ſame with the alabaſter; and the precious ſtones are, according to their hardneſs and country, every where divided into Oriental and Occidental ones.

VIII. *Baſaltes.*

Strabo and *Agricola* relate, that the antique baſaltes is found in Egypt in the ſame priſmatical form, as that in which it offers itſelf in many other European countries. I have proved in one of my former Letters, that the Vicentine, Paduan, and Veroneſe baſaltes, is but a cryſtallized lava; I add, that the common black antique baſaltes agrees not only with the viſible ſubſtance and hardneſs of the lava priſms, and the compact lavas of Veſuvius or *monte Albano*, but likewiſe on account of its nature aſſayed by fire. The likeneſs or ſimilarity is ſo compleat, that there appears no difference at all, and the hard lava or ſelce of *monte Albano* is commonly uſed in the reſtorations of mutilated antique baſalt-ſtatues. The white garnet-like ſherl-cryſtallizations and lamelles, which are ſo common in the Italian lavas, offer likewiſe, though ſomewhat ſmaller, in ſome varieties of the Egyptian baſaltes. Therefore it ſeems to me undeniable, that ſome ſpecies of baſaltes are true lavas and volcanic productions. However, I dare not aſſert that all the varieties of Oriental baſaltes are of that origin; I have rather very good reaſons to believe, that ſome of them are produced by aqueous mixtures, and that nature works, perhaps

haps, the ſame effects by the different cauſes of fire and water. I ſhall be preſently more particular on this ſubject. The varieties of antique baſaltes, which I ſaw at Rome, are as follows.

1. *Baſaltes Orientalis Niger* is black or dark grey, of a fine grain, mixed with ſmall white ſcales, which ſeem to be ſherl; and with ſome little white veins or fiſſures, filled by a ſubſtance which is either quartz or a ſpecies of ſherl. I have more than once noticed the near relation of ſherl and flints. This ſpecies of Oriental baſaltes is moſt common, extremely hard, and entirely ſimilar to Albano-lava or ſelce. It is likewiſe the moſt homogene and ſimple in its mixture without ſherl-cryſtallizations.

2. *Baſaltes Orientalis Niger, cryſtallis minutis immixtis*, black-grey, of the ſame grain, but ſprinkled with plenty of white garnet-like cryſtallizations and black gloſſy ſherl-lamelles. Some ſtatues of that kind in the *villa Albani*.

3. *Baſaltes Orientalis Niger*, commonly called *Fiorito*, black and white marbled in irregular waves. The white ſpots are entirely undetermined.

4. *Baſaltes Orientalis cum partibus conſtitutivis Graniti æquabiliter mixtus*; black, and of the ſame grain as the precedent ſpecies; but ſprinkled with ſeparated particles of quartz, red feld-ſpath and mica, which ſeem to have been mixed in an

aqueous ſolution of baſaltes, and to prove that this baſalt-ſpecies had rather an aqueous than a fiery origin. In the yard before the Muſeum in the capitol, to the left of the door, is an Iſis made of this baſaltes.

5. *Baſaltes Orientalis, faſciis granitoſis*, the common black baſaltes faſciated with large ſtripes of red Granite, blended and joined to the baſaltes without any viſible ſeparation, not as the pebbles in a breccia, or as fiſſures healed up and filled with Granite, but as if both the baſaltes and Granite had been fluid and dried together. This ſort differs from the preceding in the cloſer connection of the Granite-particles, which appeared ſeparately in the above deſcribed. The two water-ſpouting Sphinxes, at the gradini or ſtairs to the capitol, are ſuch baſaltes with Granite-ſtripes, one having an ear of red Granite, and both having large tranſverſe ſtripes. If we do not with ſome Italians ſuppoſe that even Granites can be produced by fire, we are forced to conſider this ſpecies as produced by water. However, I dare not decide any thing. Either may be poſſible. *Rerum mihi natura perſuaſit nihil de ſe incredibile exiſtimari.*

6. *Baſaltes nigerrimus maculis ex Hornblende viridescenti.* The ſtone-cutters and dealers call it *Pietra*

Pietra d' Egitto, Pietra nefritica; and I have ſeen and bought ancient weights made of it.

7. *Baſaltes Orientalis Niger, cryſtallis majuſculis albis granati-formibus immixtis.* Entirely ſimilar to a lava with great white garnet-like ſherl-cryſtallizations, differing from *n.* 2. only by a greater ſize and diſtincter form of the cryſtallizations. Though ſome marble-dealers aſſured me of its being antique, I doubt it, ſince it entirely agrees with a black-grey lava of *monte Albano*.

10. *Baſaltes Occidentalis Mollior*; thus they call at Rome an antique and Oriental baſaltes, on account of its ſoftneſs. Its colour black-grey, with ſmall little points and ſome ſmall gloſſy ſcales. A variety of *n.* 2; but I have ſubmitted here to the arbitrary difference of the ſculptors.

9. *Baſaltes Orientalis Viridis*, green, extremely hard, homogeneous, and compact, without any cryſtallizations. Statues made of it in the *capitolio et villa Albani*.

10. *Baſaltes Viridis, punctulis cryſtallinis albis aſperſus (baſalte pedocchioſo)*, green as the ſpecies 9; but ſprinkled with ſmall white cryſtalline ſherl-points; ſcarce. Two columns made of it are ſaid to be in the church of *S. Pudenziana* at Rome; but I did not ſee them.

LET-

LETTER XVII.

Siena, May 4, 1772.

I GIVE you to-day an abstract of my journal from *Rome* to *Siena*; but, should the shortness of time not now permit me to take proper notice of the Learned, and their collections, which I have seen here, I shall do it in my next from *Florence*. The road from Rome to Siena is, for a Naturalist one of the most remarkable in Italy. I do not repent therefore having travelled it over a second time.

A. From *Rome* to *Viterbo* I went by the *Porta di Popolo*, and saw the continuation of the abovementioned calcareous hills and *monte Mario*, which ran with me to *Ponte Molle* or *Emilio*, where these hills stretched to the left, and followed the direction of the Tiber. Immediately after *Ponte Molle* succeeded volcanic tufo-hills; 1. Yellow, with fragments of black pumice-stone, and white farinaceous decayed garnet-like sherls. 2. White-grey composed of white puzzolana. 3. Entirely white,

white. 4. White hills of *Piperino*, or a mixture of white ashes, black small sherl points, some glossy sherl-lamelles and inclosed fragments of limestone, as in the *Piperino* at *Marino*, near *M. Albano*. This continued till *monte Rosi*. The road covered with black sherl-sand washed by rain. Behind *monte Rosi*, on the road to *Ronciglione*, a lava-torrent; and somewhat further, a small lake, *Lago di monte Rosi*, which seems to have been an old volcano. Near *Ronciglione* a deep beautiful valley, stretching through a high yellow-brown tufo-hill, with many picturesque romantic views. Followed a large lake, *Lago di Vico*, a sunk crater of an old volcano. *La Montagna di Viterbo* is a remaining part of its former circumference; and *monte Venere*, in the lake, a part of its kernel or nucleus, being of the same substance as *Montagna di Viterbo*. This high mountain consists of the following materials, accumulated without any order:

a. Black compact lava, with plenty of vitreous or farinaceous greater and smaller sherl-crystals. *b*. Decayed lava, at the least touch mouldering into a black-grey powder, with inclosed large white garnet-like sherls likewise decayed. *c*. Beds or torrents of compact black lava. *d*. Black-red hardened *pozzolana*; with *e*. red pumice-stone. *f*. *Piperino*, consisting in white-grey puzzolana, mixed

mixed with black sherl feathers and lamelles. I saw here square columnar pieces of piperino, about one palm long, which proved that even the piperino has a natural tendency to a regular crystallization, or to break into regular forms of lava-basalt. *g.* Yellow tufo, with black pumice-stones alternating with piperino, from *Viterbo* to *monte Fiascone*. In these yellow tufo-hills I observed large, globular, or oval black lava-lumps, which decayed or mouldered into concave or spheric scales. These boulets or nodules resemble the trap-nodules in Westgothland in Sweden, but they are superior to them in bigness. They have been likely thrown out of the volcano in glowing lumps, and by succeeding cooling got the quality to crack in spheric scales.

B. From *Viterbo* to *monte Fiascone*, piperino alternating with yellow tufo or ashes. Behind *Viterbo*, to the left, a *Solfatara* or *Bulicami di Viterbo*, being a lake of hot water, which smells like *hepar sulphuris*. Half-way to *monte Fiascone*, to the left, a pool of similar but cold water; which, from continually throwing up air-bladders, seems to boil. All around, and close to it, are lava-hills, with white farinaceous garnet-like sherls; but this lava is, by subterraneous steams of vitriolic and sulphureous acids, changed into a light and red porous argillaceous stone, entirely

similar

similar to the changed lavas in the *Solfatara* near *Pozzuolo*. Elixiviated, it would, in all probability, yield the same alum. The red argillaceous stone seems to be produced by lava, more affected by the sulphureous acid, and by a dissolution of the iron particles into a colcothar or crocus martis. A great quantity of sulphur sweats, or evaporates, from the dissolved white lava or this lava-clay.

Somewhat further to the left, is a hot boiling spring, which depose a glutinous sediment hardening in the air; and both the pool, and this spring, are called *i Pantanelli di Viterbo*, a popular denomination, the origin of which I could not make out.

C. From *Monte Fiascone* to *Acqua pendente*. 1. Grey, hard and compact lava, with black and green transparent sherl pebbles, similar to dark-green crysolites. Some topaz-coloured. 2. Grey compact lava, with white oblong columnar sherl or stangen-spath. 3. Detached stones ferruminated of black and green sherl with mica. 4. Grey-yellow tufo hills alternating. 5. With red, white, and grey sprinkled lava, containing black and greenish sherl-pebbles; a singular species of lava. The red spots are tile-coloured, friable, unaffected by acids, either argillaceous or indurated puzzolana. The grey ashes (4) alternate likewise 6. with grey, hard, and compact lava, 7. with

7. with white loose lava and its farinaceous sherls, affected or dissolved by sulphureous acids. 8. Near *Bolzena*, close to the right hand of the road, a remarkable basalt-hill. Its ground or foot is a stratum of grey volcanic ashes, mixed with small farinaceous white sherl points, one fathom thick, nearly horizontal, and composed of parallel smaller beds or stripes, produced, as the beds in the volcanic tufo-hills, near Naples, by the equal falling of the ashes. These grey ashes are entirely unaffected by the acids, probably owing to their having been ever destitute of calcareous particles, or having been elixiviated by many years rain-waters. Now and then appeared in it some small grey pumice-stones. On this cinericious bedding lieth, for a long extent, stretching on both sides five or six fathoms, a stratum of regular basalt-prisms. Their substance hard compact lava, sprinkled with small, white, vitreous garnet-like sherls, or with small black sherl-feathers; scarcely any interval between them; each column or prism five or six palmi long, one palm diameter, on both ends flat; generally of an hexagonal form, either with equal sides or two opposite greater ones; some of five, four, and three sides; upon the whole, so regular, that their crystallization cannot be doubted, and being composed of lava, its crystallization, when in a state of fusion, cannot be controverted. They

riſe with the upper ends about twenty degrees above the horizontal-line, dip with the under ends in the mountain, and both ends entirely flat, not convex or concave as the articulated Iriſh baſaltes. All along the roads about Bolzena many of theſe priſms are raiſed. The Ancients employed them for grinding corn (*Plin.* lib. xxxvi. c. 18.) *Kircher*, in Muſeo, mentions theſe *Bolſena*-baſaltes. Above this ſtratum of regular baſaltes, the mountain conſiſts of the ſame but undetermined lava; that is to ſay, of a black compact lava, irregularly cracked and broken; though, in many places, with ſome tendency to a cryſtalline form. The white garnet-like ſherls in the Bolzena-baſalt-priſms are the ſame as in the antique baſalt pedocchioſo, and other antique baſalts.

This baſalt-hill is cloſely ſituated near the *Lago di Bolzena*, and together with the other hills which incloſe this lake; but a remaining part of the old volcano, which ſunk into the ground, and left this water, ſo as generally all ſuch lakes in Italy; as *Lago di Vico* near *Viterbo*, *Lago di Bracciano*, *di Nemis*, and many more, are ſuppoſed to have been produced.

From *Bolzena* to *Aquapendente*, are volcanic aſhes and lavas, with white ſherl-cryſtallizations. In the tufo-hills, near *S. Lorenzo alle Grotte*, I obſerved a great number of artificial caverns, being either

either puzzolana-quarries, or shelters for cattle and implements of husbandry.

D. In my journey to *Radicofani*, I descended from Aquapendente and a lava-hill into a valley, which seemed to have been a part of the periphery of an old volcano sunk into the valley. Soon after I passed an arm of the *Paglia*-river, behind which I saw hills of grey and blue unstratified marl, with blunted and detached limestones. I passed afterwards several branches of the Paglia, filled with these limestones, sand, and marl, and blunted pieces of a pudding-stone, ferruminated of rolled globular fragments of lava, and white limestones in a calcareous cement. This Breccia is called in Italy *cicerchina*; and I saw the same in Krayn, and in the pebbles of the river *Greve* near Florence, where they employ it to the coarser grinding of marble.

The Radicofani-hill, whereon the castle is situated, is a steep and isolate volcanic rock, surrounded every where in the valley with the beforementioned marl, and composed 1. of grey; 2. black and compact; 3. porous; 4. red and compact lavas; 5. red pumice-stones; and 6. a black compact lava, with white transparent garnet-like sherl-crystallizations. These varieties alternate without any order; and generally they are split and broken into perpendicular fissures, or irregular

undetermined polygone forms. However, there appear in the mafs of the rock fome diftinct hexagonal-quadrangular and triangular large bafalt-colonnes and truncated maffes of them, obliquely peeping from under ground. Hence may be juftly concluded, that the whole mafs of lava, which compofes this hill, had a general tendency to cryftallize into prifms, but that its preffure and quantity did not permit every where an equal and diftinct cryftallization. In fome prifms of this lava are inclofed fragments of white limeftone; fuch as I have noticed with the lavas of Vefuvius and *monte Albano*. No volcanic afhes, but marl, is to be feen all around this huge lava-lump; I could not difcover any mark of a former volcanic crater or funnel, though there be, hereabout, a traditional faying of its former eruptions. I conjecture, therefore, that the funnel was in the valley, and has been covered by marl. Directly above Radicofani, on the other fide of the valley, rifes a higher lava-hill, called *S. Fiore*; which may have had, perhaps, in the finking plain of its fummit, an ancient volcanic funnel *: however, it is more

* This mountain called *Montagna ammiata*, or *di S. Fiore*, or *Santa Fiora*, confifts on one fide in lavas and volcanic materials; but on the other, which I did not fee, it is calcareous according to Mr. *Targioni Tozzetti's* authority. I faw in his collections

more credible, that *S. Fiore*, and the caſtle-hill of *Radicofani*, are remaining lava-lumps of the wide periphery

collections, and in ſome others at *Siena*, the following foſſils found there.

a. Black lava, with white garnet-like ſherls, entirely reſembling thoſe of Veſuvius.

b. Piperino or Granito di S. Fiora; a particular ſort of lava, compoſed by a large quantity of white ſherl in oblong parallelopiped cryſtals; much black ſherl-mica, and ſome lava. If the white ſherl be ſuperabundant, or more copious, it is called hereabout *Pietra Salina*. Such is dug in *S. Fiore à Pian Caſtagnaro*, near the abbey *S. Salvadore*, and all along the Paglia; and has been much employed in the ancient walls of caſtle *Radicofani*. The ſame *Pietra Salina* ſerved at *Tolfa* in the ſupports of the alum-pans. I have ſeen in Mr. *Targioni Tozzetti's* collections at *Florence* ſome white ſherl-parallelopipeds, the length of a finger, and proportionably thick, found in the Piperino di S. Fiora; but generally they are ſmaller. Properly the name of *Piperino* is belongs only to indurated volcanic aſhes or tufo with ſherl-cryſtals; accordingly, the above-deſcribed of S. Fiore, being a lava, ſhould not be called by that name; *ſed verba valent ſicut nummi*. I ſaw in Siena two other varieties of this *Piperino* or *Granito*, which laſt is a ſtill more proper denomination. One conſiſted in black ſherl-grains and irregular garnet-like white ſherl-cryſtals; and the other is a red earth, ſimilar to a red puzzolana, with regular garnet-like white ſherl-cryſtallizations.

c. Black vitreous lava, entirely ſimilar to the Iceland-agate.

d. Globular nodules of black lead or molybdæna, often of the bigneſs of a fiſt.

e. Greeniſh

periphery of the ancient volcano; which, in former times, roſe between them, and, after having burnt out, ſunk in the interjacent valley, and is now covered all over with marl. By the following accounts, it will appear that this marl ought to be conſidered as a marine ſediment, and that the lavas and volcanic aſhes are buried under it.

E. From *Radicofani* to *Siena*; the road continues to *S. Quirico* over grey and blue marl-hills; which, in ſome depth, were entirely blue, conſiſted in lime, mixed with clay, fermenting with acids and the above-mentioned blunted limeſtones. Near the inn *dello Spedaletto* I obſerved in this marl ſome thin calcareous ſtrata, with ſea-ſhells.

e. Greeniſh ſteatites or bacon-ſtone.

f. Calcareous earth, *agaricus mineralis lac lunæ.* I do not know exactly whether it be calcareous or ſelenitic.

g. Mercurial clay, with adherent cinnabar; found in the volcanic ground near Silvena nella Contea di S. Fiora, in monte S. Fiore; the cinnabar ſublimated by ſubterraneous fire into the ſurface of this high elevated ground. There appears cinnabar even in the cracks and joints near the ſurface or the day of this volcanic hill. I did not mention it in one of my former letters. They ſhewed me quartz-cryſtallizations from Silvena, pretending them to have been found in volcanic productions. But I doubt it. They may have been found, perhaps, on the calcareous ſide.

h. Grey ſtriated antimony in lava, from Silvena.

i. Cinnabar-lumps, from the abbey *di S. Salvadore alla Montagna di S. Fiora.*

Near *S. Quirico* the hills consisted of calcareous tufo, with inclosed sea-shells. This tuphus or porus consisted of a light-yellow fine calcareous earth, mixed with some clay, ferruminating and containing different species of sea-shells, small blunted quartz, and limestone spar-grains, and oval lumps of green marl, whose colour is like the mountain green, or chrysocolla. There is a great variety of well-preserved shells in this yellow lime-porus; among several great echinites there appear, now and then, the *cucurbites*, or the *echinites floridus*. *Mercati Metallotheca Vatic.* p. 233. It contains likewise a singular pyrites, which *Mercati* calls *nummum diaboli*. Near the country-seat *Casa nova* are found *Iridi nere*, or loose and separated black quartz-crystals, pointed on both ends. I had passed in this way over many arms of the river *Fiumirigo*; in which the blunted limestones are very common. They are either employed in mending the roads, or gathered to be burnt into quick-lime. Some Italian miles before I reached *S. Quirico*, I met with the celebrated *Bagni di S. Filippo* *. The houses in S. Quirico were built of

* These hot springs lye on the descent of mount *S. Fiore*, and depose a sediment of sulphur and a fine calcareous porus or tuphus, which is more or less penetrated by vitriolic acid, or more or less selenitic. They are described by Dr. *Leonardo Vegni*,

of travertino, a proof of neighbouring limeſtone. Likely they fetch this travertino from *Rapolana*. Behind

Vegni, in a Letter to Profeſſor Gaetano Monti at Bologna; printed at Bologna, 1761, 4to. Doctor *Vegni* has eſtabliſhed there a manufactory, to precipitate this fine tufo on medals and bas-reliefs, and to get by that means the fineſt impreſſions. He cauſes this hot incruſtating water to fall from on high into a large veſſel, and to break upon a wooden croſs; whereby it is ſeparated into drops, and directed againſt the ſides of the veſſel, on which all around, the medals or bas-reliefs, or their mouldings or forms, are hanging. The falling and breaking of the water imparts a greater impulſion to its drops, and to its tufo or tartaro; which, without this manipulation, would be but farinaceous, friable, and ſpungy. The above-mentioned *agaricus mineralis*, in *Montagna di S. Fiore*, ſeems to be the very calcareous earth, and ſubſtance of this fine tufo. The hills about the *Bagni di S. Filippo*, at the foot of *S. Fiore*, conſiſt likewiſe in this tufo and its various incruſtations. Profeſſor *Baldaſſari* at Siena told me of a natural white and downy ſalt. This he conſiders as a concentrated and compact, or rather congelated, vitriolic acid *(oleum vitrioli glaciale naturale)*, entirely pure and free from any phlogiſton. Filtering the hot water through red brazil-wood the tufo gets by it a fine red colour. If it be precipitated in glaſs-mouldings or forms, its ſurface is extremely ſmooth and ſplendent. By theſe principles they make not only impreſſions of medals, but likewiſe of greater bas-reliefs; which, reſembling to marble-work, are even ſuperior to them on account of the finer colour. Mr. *Vegni* has ſucceeded already in caſting buſts of this tufo, and he ſoon hopes to caſt ſtatues

Behind *S. Quirico*, the hills which are next to the place conſiſt of a fine light yellow, ſomewhat argillaceous lime; then came marl hills, continuing to *Siena*. I paſſed ſeveral arms of the *Orcia* and *Ombrone*.

The ſoil, from *Aquapendente* to *Siena*, is, upon this account, generally conſiſting of marl-hills, under which there is certainly volcanic tufo next to Radicofani. The marl has been waſhed together, either by the above-mentioned rivers or by the ſea, which appears by the frequent foſſil ſea-ſhells near *S. Quirico*; and, is the more probable, as towards the ſea the country is ſtill moory and marſhy, being, for that reaſon, called *maremma*. The villages from *S. Quirico*, and even the houſes in *Siena*, are built of brick. The ſtreets have no other pavings; marks of the want of quarries, and of an abundance of clay and marl. Near the

of natural bigneſs. He is next to publiſh an account of the works which are manufactured here.

The warm baths at *Vignone* are about two Italian miles diſtant from *S. Quirico*. They are likewiſe impregnated with hepar ſulphuris, depoſe a calcareous tufo (which fermenting but a little with acids is rather more ſelenitic), and ſpring in all probability from *Montagna di S. Fiore*. They are deſcribed in *Oſſervazioni intorno all' acque del bagno di Vignone fatta dal D. Teofilo Grifoni*. Siena, 1705, 8vo. A ſimilar warm bath is ſaid to be near S. Quirico.

Porta Romana at *Siena*, are ſome hills of a fine yellow looſe ſand-ſtone; which, on the other ſide of the city, towards *Florence*, grows coarſer. But the city is ſituated on a marl-hill, as appears on the market aſcending to the cathedral church.

The Univerſity has ſeveral learned and celebrated Profeſſors, which are members of the Academy of Sciences, eſtabliſhed in former times; but of late revived under the name of *Academia de' Fiſicocritici*. The library, and the cabinet of natural curioſities, is common to the Univerſity and the Academy. The latter has got a great celebrity by the four volumes of its Tranſactions, publiſhed under the title, *Atti dell' Academia di Siena*, 4to.

The cabinet of natural curioſities was, ſome years ago, bequeathed to the Academy by its preſident, the Profeſſor of Natural Hiſtory, Dr. *Giuſeppe Baldaſſari*, who collected it, and has it ſtill under his inſpection. Beſides ſeveral Diſſertations, inſerted in the Academical Tranſactions, he has publiſhed, *Delle acque minerali di Cianciano relazione di* G. Baldaſſari. *Siena*, 1756. 4to. *Saggio di produzioni naturali dello Stato Saneſe che ſi ritrovano nel Muſeo del Sr. Cav. Giovanni Venturi Gallerani*. Siena, 1750. 8vo. I am ſorry for not having ſeen this collection. *Offer-*

vazioni ſopra il Sale della Creta, &c. del Sr. D. G. Baldaſſari. *Siena,* 1750. 8vo.

The following articles ſeemed to me the moſt remarkable in the Academical-cabinet.

1. Coals, either bituminous wood or true coals, and argillaceous ſlate, impregnated with petroleum, lie in flats or beds under the clay and marl-hills in ſeveral parts of Toſcana.

2. A jaw, with the teeth of an unknown animal, found in a marl-hill in Toſcana, and deſcribed by Mr. Baldaſſari in the Academical Tranſactions—agrees with an American jaw deſcribed by Mr. Guettard in his Memoirs.

3. A blunted limeſtone, worm-eaten by pholades, found in a marl-hill in the Saneſe.

4. Yellow ſand-ſtone, with a petrified ſea-ſtar or aſteria; from a hill near Giuſuri, a mile diſtant from Siena.

5. Black quartz-cryſtallizations; either pitch-black throughout, or only tinged in the ſurface; having eight triangular faces, or rather the form and bigneſs of rough diamonds; from *monte Pulciano.*

6. Native yellow ſulphur in cubic cryſtallizations, incloſed with pyramidical calcareous ſpar in grey limeſtone; from *S. Agatha di monte Feltro in Ducato d' Urbino,* in *Romagna.* This native ſulphur reſembles a yellow knotty blende; but yields

a yellow

a yellow ſulphur-powder as ſoon as ſcraped with the nail.

The private cabinet of Dr. *Baldaſſari*, which is to be delivered after his death to the Academy, contains ſeveral remarkable curioſities. I notice,

1. Native ſulphur, in a large yellow, tranſparent cryſtal, half an inch diameter, nearly of ſherl or columnar form; from *S. Agatha di monte Feltro.* A ſcarce and precious piece indeed!

2. White and black quartz-cryſtallizations, pyramidical on both ends; *(Iris nigra Aldrovandi, lapis Dichonus Mercati in Metallotheca, Ingemmamenti cryſtallini appuntati in ambe le parti di Ferrante Imperato)*; found looſe and detached in the ſurface of the earth in many places of the Saneſe; ſuch as, *Leceto, al bagni di S. Filippo, di Cianciano, a Belriguardo,* &c.

3. Dark-green quartz-cryſtallizations in and on dark-green *ſodſlag*, or *aſbeſtus fibris abruptis et conglutinatis (Cronſt. Mineral.* § 105), which ſeems to have dyed or tinged them. Mr. *Baldaſſari* did not remember poſitively, whether this rare curioſity came from *monte Chriſto*, or from *Giglio*, two ſmall iſlands in the Tuſcan ſea.

4. Blue quartz-cryſtallization, from a copper-mine in the Saneſe.

Shells

Shells petrified into agate, in a yellow fine tophaceous ſand-ſtone, found in a ſand-hill at the Florentine gate at Siena.

6. White and tranſparent petrified turbinites in a ſimilar ſand-ſtone; the turbinites hollow.

7. Native copper in quartz, with cryſocolla, from a new-diſcovered mine at *Paris*, in the Saneſe, twenty-three miles diſtant from Siena, cloſe to the *Via conſularis* to *Groſſetto*.

8. Grey antimony in large and long cryſtals, covered with cryſtallized native ſulphur and farinaceous auripigment, from an antimony-mine, near *Pereta nella Maremma Saneſe*.

9. *Granite*; the ſubſtance of ſome hills in the Saneſe.

10. Argillaceous ſlate, from Montagnuola and Prata, in the beginning of the *Maremma Saneſe*, where it is in large hills covered with calcareous; deſcribed by Mr. *Baldaſſari* in the eleventh volume of the Saneſe Tranſactions, or in his Sketch of a Natural Hiſtory of Prata.

11. Argillaceous ſlate, with white marble veins, without any quartz; different from the preceding ſpecies on account of its antiquity and poſition, as being not inferior to the calcareous ſtrata; but ſtratified in the calcareous hills near Gerfalco, between that place and Prata. The micaceous ſtripes

ſtripes in the Greek *Cipollino*-marble are, perhaps, owing to a ſimilar poſition.

12. Micaceous ſlate with dendrites, from *Montagnuola preſſo la villa Cettenati*, eight Italian miles diſtant from Siena.

13. Sand-ſtone, from *Belriguardo*, three miles diſtant from Siena.

14. Travertino, from *Rapolano* in the Saneſe; produced there by the ſediments of hot waters. *Rapolano* is ſituated at the entrance of the valley, called *La Valle di Chiana*, twelve Italian miles from Siena; celebrated on account of its baths, which incruſtate like the Bagni di S. Filippo whatever is laid into them.

15. *Serpertino* or *Gabbro*, green and black ſpotted, from Vallerano in the Saneſe; called by the ſtone-cutters *Marmo di Vallerano*.

16. *Serpentino* or *Gabbro*, from *Prata*, is green and black, or red ſpotted; commonly called *Verde di Prato*.

17. White ſcaly marble, as beautiful and ſaline as that from Carrara, from *Montagnuola* in the Saneſe; the whole mountain being commonly grey, it is found but in ſmall blocks or lumps.

18. *Brocatello di Siena*, a yellow marble with black veins; the ground ſometimes purple; but burning makes the whole red coloured; dug at *Montarenti* in *Montagnuola*, in the *Saneſe*; eight Italian miles

miles distant from Siena; generally known, and much employed in Italy.

19. *Marmo tigrato di Vall' di Rati*, a fine spotted marble.

20. White handsome alabaster, and *alabastro fiorito*, dug at *Castel nuovo dell' Abbate*, in the *Sanese*.

Dr. *Calluri*, professor of physic at Siena, has a small but choice collection of Natural History. I noticed the following pieces.

1. A petrified shell in a flint *(sylex pyromachus)*, from *S. Cianciano de Bagni*. *S. Casciano de Bagni*, in the *Sanese*, is different from the precedent place; and described in *Analisi delle aque minerali di S. Casciano de' Bagni, &c. di Annibale Bastiani*. Firenze, 1770, 8vo.

2. Microscopical shells, as described and drawn by *Janus Plancus*; common in several sand-mixed clay-hills, two miles distant from Siena, on the road to Florence.

3. A petrified wendel-trapp *(turbo scalaris)*, a scarce and precious shell, found in an argillaceous sand hill near *monte Algino* in *Toscana*.

4. Several univalves, compressed and crushed by the pressure of the superior beds; petrified from the hills near *monte Algino*.

5. White fullers earth, dug at *Personatina* near *Cettinale*, seven miles distant from Siena.

6. *Nummi*

6. *Nummi diabolici Mercati*, round and flat pyrite-lamellæ, from *Cuna*, ſix miles diſtant from Siena, on the road to Rome.

7. Magneſia, from *S. Cianciano de' Bagni*.

8. Quartz-cryſtallizations, with an air bladder and incloſed water, from the Saneſe.

9. Lamellated quartz-cryſtal, from the Saneſe. The ſame frequently found in Chriſtina-ſhaft, at Shemniz, in Lower Hungary.

10. Oblique rhomboidal tranſparent gyps-cryſtals, four inches long, two inches large, called *ſpecchio d'Aſino*, found near *Villa di Cetinali nella Montagnuola*. Some are ſaid to double the objects.

11. Large black and columnar ſherl, from *monte Chriſto*, a ſmall iſland near *Iſola di Gighi*, on the coaſt of Toſcana.

12. Some copper ores and malachites, from the mines near *Maſſa di maremma*, in the *Saneſe*.

13. Agates, amethyſts, and quartz-cryſtallizations, from *Maremma*, ſome miles diſtant from the copper mines at *Maſſa*.

14. Slate, with pyrite-cubes or marcaſites, from *Rocca Strada*, near *Maſſa di Maremma*.

15. Great white argillaceous and ſulphureous bullets, ſome of the bigneſs of a man's head, from *monte Antico*, three Italian miles diſtant from the baths at *Petriulo* in the Saneſe; deſcribed by *Pinelli*

Pinelli in his *Lettera de' Bagni di Petriulo.* Roma, 1716. 4to.

Dr. *Tabarani*, profeſſor of Anatomy; a celebrated man, who deſerves the attention and the eſteem of any traveller.

Having in the deſcription of profeſſor Baldaſſari's cabinet mentioned, that in the Saneſe the ſlate is conſtantly running under the limeſtone, I ſend you Mr. *Giov. Arduini's* obſervations, made in 1756, as he happened to diſcover the copper vein near *Montieri e Bochejano*, in the Saneſe, whoſe working and melting of copper, ſilver, and blue vitriol, he ſuperintended for ſome years. Mr. *Arduini* has inſerted in the *Magazino Toſcano*, printed at Livorno, the firſt deſcription of *Montieri*, together with a map; but this magazine being dropt ſoon after, this Deſcription is incompleat; for which reaſon, the following paper, which Mr. *Arduini* made me a preſent of when at Venice, was the more agreeable to me, and will be ſo to you. I have only to remark upon it, that Mr. *Arduini's* opinion on the origin of travertino (a porous limeſtone) perfectly agrees with Mr. *Raſpe's* * on the origin of the ſaline marbles, which he

* See his account of the ſediments of the Bagni di San Filippo near Radicofani, inſerted in the Philoſophical Tranſactions;

he has propoſed in a Diſſertation preſented to the Royal Society of London; and, that the obſervation of priſmatic cryſtals in the old ſilver-ſlags, ſeems to me very remarkable. Likely the ſherls in the lavas formed themſelves in the ſame manner.

APPENDIX.

Tranſlated from the Italian.

At *Montieri* in Toſcana, in the valley *della Merſa di Montieri e Bochejano*, the ſlate is obſerved to be inferior to the ſuperincumbent lime and marl. The ſame is ſeen in many other places; as, for example, at *S. Giovanni alla vena* in the Piſane mountains. Between the ſlate and the ſtratified lime, or marl-ſtone: (as likewiſe in other places between the ſame ſlate and a ruſty greeniſh vitreous Galeſtro, filled with ſpar-flakes, which in ſome places covers the ſlate:) is conſtantly running and obſerved a large matrix, many fathoms broad, which varies on account of its conſtituent foſſils and materials as the ſuperincumbent materials.

actions; or rather, in the ſecond, much improved, Edition of his Natural Hiſtory of the Earth, which is preparing for the preſs.

This matrix or large vein runs a long way in the hills *della Maremma*, between *Gerfalco e Prata* towards *Roccaſtrada*: where covered with limeſtone, it is calcareous; where, with Galeſtro, it is moſtly compoſed of vitreſcent materials. Upon the whole, it may be conſidered as a confuſed union of limeſtone, marl, quartz, ſpath, pyrites, and marcaſites; yellow ſprinkled copper-mine, blende, lead-ore with ſome ſilver, magneſia, black iron-ore, gloſſy and magnetic mica, and quartz-cryſtallizations. But theſe materials are not diſtributed alike every where. In ſome places different materials are predominant; for example, near *Gerfalco* it is magneſia; *alla merſa di Bochejano*, it is copper and iron; and here the matrix is almoſt entirely quartz, this part being covered with Galeſtro. In ſhort, this great vein conſtantly covers the ſlate. Beyond *Botro di Cagnano alla Carbonaje di Montieri* (a valley deſcending from the high mountain of *Montieri*) towards the Weſt the above vein appears in the ſummit of a hill, called *Poggio del Duca Salv ati*, and it is here begins the limeſtone of this vein; which, hereabout, is called travertino or columbino, and is the only ſtone in theſe parts that yields a good white and laſting quick-lime. It is extremely ſpungy, without any regular ſtratification, deſtitute of marine bodies, and entirely reſembling

reſembling the tophaceous incruſtations or ſediments of the hot-wells at *S. Quirico*. It begins inſenſibly and thinly, as it were, to run from this vein down to *Marſa* and towards the ſea. It forms different hills of a conſiderable elevation, and is conſtantly ſuperincumbent on the ſlate and the Galeſtro. It was probably produced by the long runnings and precipitations of hot boiling ſulphureous waters, which ſprung from this vein, and from amidſt the ſlate and the ſtratified limeſtones. This travertino is conſtantly ſeen further to the Weſt, near *monte Rotondo* and in the *Volterran*. Near *monte Rotondo* and an ancient caſtle, they have found even in this calcareous tophus a vein of lead and ſome ſilver. The ſame phænomenon occurs in the *Montagnuola di Siena*, at *Montarenti*, in the quarries of the *Siena-Brocatello*. In this place riſes from under ground a ſlate rock, towards the Weſt covered with many vertical dipping beds of ſaline-marble, among which there is that of the *Brocatello di Siena*. Here the travertino, under the above-mentioned form, ſeems to iſſue from between the marble and the ſlate; and covering the ſlate towards the Eaſt, it dips gently ſloping into and under the lower plain, which is filled with ſea ſand, or yellowiſh arenaceous Sienatophus.

The caſtle of Montieri is, for a great part, built upon the ſlags of the ancient ſilver mines of Montieri. Theſe artificial ſlags or ſcoriæ contain, if broken, tranſparent priſmatical cryſtallizations of gypſum or ſelenites *.

* Similar cryſtallizations in a ſmelted ſubſtance have been lately obſerved by Mr. *Kair* in the common glaſs-maſſes, which for a long while have been expoſed to a violent furnace-fire. The glaſs-maſs of thoſe ſamples, which I have ſeen, is of a blueiſh tranſparent colour, and the cryſtallizations appearing and produced in it are of a white colour, and in a globular lamellous form, exactly reſembling the ſeed of Naſturtium. He has preſented an account of this obſervation to the Royal Society; and, together with the above obſervation of Mr. *Arduini*, and ſome of my own, it greatly countenances Mr. *Ferber's* hypotheſis on the origin of the cryſtallized ſherls, which are found in the lavas.

LET-

LETTER XVIII.

Florence, May 14, 1772.

ON the road from Siena to this place, I obſerved the following varieties of the ground.

Near the Florentine-gate hills of common coarſe gritty brown-reddiſh ſea-ſand, either looſe and incoherent, or hardened into arenaceous ſtone. A finer and yellow variety of it appears beginning on the other ſide of the city near the Roman gate. I believe I have obſerved, that this ſand and theſe ſand-ſtones are ſuperincumbent on the before-mentioned marl-hills, which I noticed between Radicofani and Siena. I obſerved in this ſand and ſand-ſtone beds, the following ſmaller or thinner ſtrata and mixtures, which ſucceeded or followed without any order. *a.* Now and then a ſtratum of grey limeſtone, incloſing *b.* A thin bed of oblong and ſmall oyſter-ſhells, of the ſame ſpecies, and nearly reſembling the oyſters in *Gual-*

tieri Teſtarum Indice, Tab. 102. Fig. D. *c*. White clay in lumps, incloſed in the ſand-ſtone. *d*. A mixture of ſand and calcareous white mould. *e*. Near *Staggia* ſmall and decayed petrified ſhells in a yellow limeſtone ſomewhat ſand-mixed. It is obvious, that all theſe varieties in the ſand-hills are owing to different ancient ſediments of the ſea.

From *Staggia* to *Poggibonzi* and *Tavernelle*, I obſerved either limeſtone under the ſand-hills, or travertino ſuperincumbent on them, and probably produced by the Apennine waters; or the marl-hills appeared bare without any covering. Theſe marl-hills conſiſted either of ductile and tough, or petrified marl, which incloſed many blunted limeſtones and ſome ſea-ſhells. Theſe limeſtones appeared painted with iron-dendrites; ſome worm-eaten by pholades; ſome penetrated and croſſed with veins of black horn-flint.

From *Tavernelle* towards *Florence* the ſoil conſiſted either of theſe ſand and ſand-ſtone hills, with oyſter-ſhells and incumbent travertino; or of marl-hills with detached limeſtones; or of grey limeſtone, which formed ſome hillocks.

Some miles before I reached *Florence*, I obſerved on both ſides of the Greve-river *, argillaceous

* The Greve-river offered the following rolled blunted ſtones.

a. Grey,

ceous slate suddenly arising from under ground, or dipping into it, towards or under *Florence*, and undoubtedly under the Apennines. This slate was, in the greatest visible depth, pure and unmixed; but in the same proportion it came nearer to the surface, it was mixed with mica; insomuch, that the uppermost ceased to be shivery, and resembled rather a sound macigno, as appeared in the quarries near the road in *monte Buoni*. Now and then there appeared in it small black argillaceous and bituminous nodules.

Nearer towards *Florence*, above the argillaceous slate which dipped in the ground, I found grey limestone, which continued to the city.

a. Grey *Cicerchina*, or fine-grained calcareous breccia, composed of globular white limestone-pieces, small globular fragments of lava, some quartz-grains, and a lime-cement; mixed sometimes with green petrified argillaceous spots; employed in the marble-grinding.

b. Red *Cicerchina*, of a reddish lime-cement and blunted pieces of black lava.

c. Large fragments of black lava with inclosed white limestone.

d. Black-white-spotted porphyry, similar to the *serpentine ner' antico* described in one of my Letters from Rome; is said to be found in some Tuscan-hills; as assured to me by Mr. *Targioni Tozzetti*, and evidenced by these fragments.

e. Red and brown-mixed jasper.

f. Red and brown-mixed petrified calcareous earth.

The whole road from *Siena* to *Florence* is undoubtedly one of the moſt charming in Tuſcany. It ſeems to be rather a garden walk than a road, becauſe it runs between ſome hills, which are cloathed with olive-trees, cypreſſes, different firs, oaks, beeches, &c. The great number of country ſeats, old caſtles, and villages, make it extremely agreeable: and, to my knowledge, there is in Germany nothing comparable to it, except, perhaps, the country between *Meiſſen* and *Dreſden*, which is extremely beautiful, though it be of a ſmaller extent, and planted with leſs variety of trees and greens.

I ſhall at preſent continue my accounts of *Florence*, which I began, and for a great part have ſent you, as on my way to Rome I happened to be in this place.

The Spital of *S. Maria Nuova* is a well-ordered eſtabliſhment; to which is annexed a ſchool of phyſic and ſurgery, a library, an anatomical theatre, a botanic garden and a diſpenſary. Doctor *Ranieri Maffei*, a young man of parts, teaches anatomy. Abbate *Giovanni Lapi* is public lecturer of botany, member of the Florentine botanic and œconomical ſocieties, and inſpector of the botanic-garden belonging to this hoſpital. He is a ſkilful botaniſt, and adopts the Linnean ſyſtem, whoſe excellence appears in its preſent univerſal applauſe.

applauſe. Some of his publications * give great credit to his parts; but theſe ſhould be encouraged and rewarded by a better penſion. The Florentine country is, in a botanical reſpect, but imperfectly known by *Micheli's* publications, ſince properly he has only deſcribed and drawn the moſſes. *Leontice Leontopetalon*, *Aldrovanda*, &c. are found in Tuſcany, though ſcarce. The happy climate † favours the growth of exotic plants in the botanical gardens. *Melia Aredar. Callicarpa Americana*, and many other exotic plants, are kept here in the open fields, and thrive in large trunks; being in the Northern countries conſtantly kept in warm-houſes, where they never grow beyond the form of ſickly ſmall plants. If *Upſal* were in Tuſcany or Naples, our immortal Linnæus would certainly have given to Flora and its treaſures, the moſt convenient abode.

Mr. *Fabrini*, employed at the Mint of *Florence*, is poſſeſſed of a fine collection of minerals, ſhells, petrifactions, and other natural curioſities, which

* *Metodo ſicuro per diſtruggere i ſucciameli con alcune riſleſſioni di Agricoltura di Gio. Lapi.* Firenze, 1767. 8vo. *Diſcorſo ſul eſterminio del Loglio e d' altre piante nocive.* Firenze, 1767. 8vo.

† This appears remarkably in the unexampled Regale or Monopoly of *Ice*, which, by the Sovereign, is let to private farmers.

has been gathered by Dr. and Profeſſor *Xaverio Manetti.*

Dr. *Bartolomé Meſny*, a Frenchman, has likewiſe a cabinet; but on account of his abſence I did not ſee it.

The china manufactory at *Doccia*, four Italian miles diſtant from Florence, is belonging to Marquis and Senator *Lorenzo Ginori*, a ſon of the late Miniſter, who eſtabliſhed it, and has been a man of great learning in Natural Hiſtory. To obſerve the growth of the zoophytes, corals, and their ſtony branches, he cauſed ſtrong china-plates, with the dates of the day and year, to be caſt in the ſea on ſeveral ſhores of the Mediterranean; ſuch as that of Tuſcany, Sicily, and Sardinia, and to be fiſhed up again in different times. If I remember right, I have ſeen ſome ſuch plates in the Imperial cabinet, or in that of the late Aulic-agent Baron *de Moll*, at *Vienna*. This our common worthy friend had not only got acquainted with theſe Italian experiments, but examined himſelf the nature and growth of the Coralline inhabitants. To this purpoſe he had made a great many remarkable microſcopical obſervations of the Polypes in freſh water, which are of the ſame kind as the coral-animalcula: and you have ſeen, I ſuppoſe, ſome of his engraved obſervations of theſe marvellous creatures, which, being in every reſpect honourable

to

to their author, deserve to be published *. The present Marquis *Ginori* is not less a friend and connoisseur of the sciences. This appears, among several other circumstances, by the goodness and magnificent establishment of his china-manufactory, which deserves to be considered as a pattern of a manufactory of that kind. The clay, employed here, is fetched from *Tretto* in the *Vicentine*, till they happen to find an equally good one in the Florentine, which the Marquis neglects nothing to procure. In a separate room are kept in fine glasses samples and specimens of the different clays, for the greater part found in Tuscany, or in France and Germany, and employed in the china-manufactories. The Petunse and Kaolin from China are not wanting. In short, this valuable collection may be considered as a little cabinet of natural curiosities; which is the more remarkable, as the science of the earths is so very useful in common life, and as collections of that kind are so very scarce. Several sorts of quartz, fluors, and other stones, fit for china-work, are likewise taken care of; and the whole rendered more useful by an instructive catalogue, penned by the best Mineralogist of this country, Mr. *Targioni Tozzetti*. There are convenient furnaces for

* Baron *Moll* died in 1772.

the

the assays of the earths and colours. The same care is taken of the workmanship and its improvement. The workmen are, for the greatest part, natives of Tuscany, and subjects to the manor of *Doccia*. The children are, from their very infancy, by their parents, taught painting and sculpture after the best models; and, for this purpose, there is a considerable collection of prints and plaister statues and busts. I found here a painter, who, at the expence of the late Emperor, had travelled with Professor Jacquin to America, and knew many circumstances of that voyage.

Close behind the magnificent buildings of this manufactory is *Morello*, a calcareous mountain of the adjacent Apennines, bare at the top, but round about its sloping sides covered with green, fine villas, and gardens. It is to the North of Florence, and in winter-time now and then covered with snow. I returned from Doccia along its sides, and saw by the way at *Quarto* a marble-saw-mill, where I observed a large block of a species of granites, if it may be called so, compound of fat white and red Cornelian-coloured quartz-grains. They could not tell me whence it came. At the *Villa di Castella* is a garden, which *Bellonius* praised in his time as a model of good taste.

I have seen some marbles and stones dug in Tuscany;

Tuscany; which, deserving your notice, I shall describe to you.

Marmo verde di Firenze is a faint-coloured sea-green marble, found in the Florentine.

Marmo bianc' e nero di Porto Ferrajo is digging near this harbour, scarce inferior in beauty to the *Bianc' e nero antico*. Black white veined. In the sea near *Porto Ferrajo* they fish *Pinnas marinas*, whose silk, called *Pelo di Gnacchera*, is worked into gloves, stockings, &c.

Marmo polveroso di Pistoja is black with white-grey, and, as it were, pointed veins, resembling black marble sprinkled with white dust. Fine tables of this marble are to be seen in the *S. Lorenzo* chapel. Generally the hills about Pistoja consist in macigno. Mr. *Manetti* gives some account of them in the *Kiridario Florentino*, 1751, 8vo; but Sig. *Antonio Mattani*, Professor of Physic at Pisa, has described them more at large in his work, intituled, *Delle produzioni naturali del Territorio Pistoyese, Relazione istorica e philosofica*. Pistoya. 1762, 4to. *Giuseppe Matani* is Professor of Philosophy, and a Botanist. By the *Giornale d'Italia*, I see that Mr. *Gio. Antonio Stellanti*, at *Pistoja*, is a good Chemist and Botanist.

Verde di Prato is a serpentine-stone or gabbro, green, with black or red and white veins, digging at *Prata* near Pistoja.

Granito

Granito di Cortona is, as it seems to me, a grey lava, with white transparent oblong spots, resembling flint, and likely of the sherl-kind, though I have tried neither. They have, of late, established at *Cortona* an Academy of Botany, whose secretary is Mr. *Ludovico Coltellini*. Near this city they have found in the earth a contexture of fine coherent fibres; which seem to have been a Conserva, and resemble a yellow silk-paper. Mr. *Strange*, whom I have mentioned in former Letters, has described it in a Dissertation *Sopra la carta fossile, che si trova presso di Cortona*.

Diaspro di Volterra is red coloured. I have mentioned already the chalcedonies found near that place, whose adjacent remarkable country has been described at large in the Travels of Mr. *Targioni Tozzetti*: Mr. *Le Lorgne*, Professor of the French language at the *Academia de' Nobili*, at Florence, has a thought of translating this useful work into French; confining himself entirely to the Natural History of Tuscany, and leaving out the diffusive historical accounts, as merely interesting to the inhabitants. This translation would bear the better character, as Mr. *Le Lorgne* is a friend of Natural History, and has travelled many times over this country. I am alike indebted to his politeness and to his science.

LET-

LETTER XIX.

Florence, May 23, 1772.

THE ſtones employed in buildings, decorations, and pavings, are natural hints of the nature of the neighbouring hills and quarries. I have followed them at *Florence*, and can accordingly give you the following account of ſome quarries.

1. *Cave di Macigno di Fieſole.* *Fieſole* is an old Etrurian city, ſome miles diſtant from Florence to the North, ſituated between ſome macigno-hills. The ruins of this place have ſerved to build Florence in the adjacent plains. There remains at Fieſole a piece of an old Etruſcan wall, conſiſting in large ſquare-cut ſtones of macigno, which are put together without any cement. The preſent quarries of macigno near *Fieſole* are ſituated on the hill, called *Ceceri*, and in another over-againſt to the ſouth-weſt, called *Settignano*. All the other hills hereabout conſiſt likewiſe of macigno, bordering on

on calcareous-hills; such as *monte Morello*, and others. I have noticed already in one of my former Letters that *macigno* is a species of slate, composed of an argillaceous earth, much mica, and some lime; wherefore it is slowly and gently affected by aqua fortis. Near *Fiesole* the macigno is in the uppermost strata shivery or thinly-lamellated; that is to say, it consists of small beds, alternating with argillaceous strata, which are called Bardelloni. In greater depth, it grows sound and compact without any visible separation of beds, so that it can be cut into large masses and columns, which they do by many iron wedges driven into it on the same line. Now and then occur in this sound macigno argillaceous nodules, and very frequently little black spots and thin beds or veins of coals or clay saturated and black-coloured petroleum. The macigno appears in two different colours. 1. *Pietra Bigia* is grey-yellow, on account of some admixed iron-ocher; commonly found uppermost, but sometimes close sticking with the following variety. 2. *Pietra Serena*, *pietra columbina*, or *turchina*, is blueish grey; commonly used in the buildings at Florence, but moulders away in open air, in which it contracts a black colour. Many columns made of it are to be seen in the church *di S. Spirito*. The *pietra bigia* is, on account of its ochraceous mixture,

harder

harder and more durable. It ſerves in the exterior parts and walls of the buildings as the *pietra ſerena* in the inner parts and decorations, which are leſs expoſed to the air. The ſuperior beds, which are ſtrongly mixed with clay, go here in the quarries under the name of *pietra morta*, and this ſerves in the walls of furnaces and fire-places.

2. *Cave di pietra forte alle Campora*, two miles diſtant from Florence. The *pietra forte* is the ſound, fine-grained, yellow-grey, or blueiſh lime or marl-ſtone; which is employed in the pavings of Florence. It is found not only *alle Campora*, but likewiſe at *S. Franceſco di Paolo* in a wide-ſtretching low ridge of hills, three miles diſtant from the city to the South-weſt. The *pietra forte alle Campora* is found generally in horizontal beds, three or four inches thick, ſuperincumbent one to the other, but now and then ſeparated by ſimilar beds of hardened clay, called Bardelloni. In theſe laſt beds frequently offer little veins of calcareous ſpar, not above one or two twelfth parts of an inch thick; and the *pietra forte* is throughout penetrated and glued by ſpar, wherein it is remarkably different from the Bardelloni, which are but argillaceous. The *pietra forte* before this ſaturation with ſpar ſeems to have been but Bardellone; as *Bardellone* would have been changed into *pietra forte* if the calcareous ſolution or glue had not

eben hardened in the before-mentioned veins. The colour of the *pietra forte* is either grey-yellow or blueish. Sometimes both colours offer in the same bed *(laſtra)*; but generally each bed has but one colour, whence arises the different denomination of *pietra bigia* and *turchina*; though, in fact, they be of the same kind, and, on account of their clayish mixture, equally affected by the acids. In some beds of the *pietra forte*, as well as the *Bardellone*, offers a fine mixture of mica, which proves their near relation with the macigno. The macigno is not only sometimes separated by small Bardellone-beds, but likewise of two different colours, blue and yellow, something affected by acids, in the same proportion as being more or less penetrated by calcareous particles. Hence it appears, that its difference from the *pietra forte* is entirely depending upon its stronger mixture with mica, which has made it a species of Ardesia.

According to these facts, all the hills near Florence are to be considered as argillaceous, as really in a greater depth they are a pure argillaceous slate; which I have observed in the quarries in *monte Buoni*, where the macigno dips under the adjacent calcareous hills or branches of the Apennines.

In and upon the *Bardelloni alle Campora* are often observed black-iron dendrites; and *Micheli* has found

found in the *pietra forte* ammon's-horns, and several impreſſions of plants. The plates or lamellæ of the yellowiſh *pietra forte* appear in the ſurface to be traced with lines, ariſing from thin ſpar-lamellæ, which croſſing the ſtone form rhomboïdes, in which accordingly it breaks. On other ſuch plates appear worm-like mouldings, which *Scheuchzer* has deſcribed under the name, *Lapis Florentinus Lumbricaria dictus*. Red boles are common in the fiſſures and clefts of the *pietra forte*. Some pieces of this ſtone are thin-ſhivery and bent like waves, as appears in the pavings at Florence; which, however, are as flat and even as a chamber-floor; conſiſting of joined plates of *pietra forte*, which generally are broken into natural rhomboïdes and pentagons. The weakneſs of the eyes, to which many Florentines are ſubject, is commonly aſcribed to the ſhining white or grey colour of theſe pavings. But it is ſtill more common at Naples; where the lava pavings are rather of a black colour. In both places ſpectacles are very commonly and conſtantly worn.

3. *Cave di Pietra forte di S. Franceſco di Paolo.* Here are likewiſe bardelloni between the beds or plates of *pietra forte*, which is remarkably affected by acids, and croſſed by ſpar lamellæ, that form pentagons. In the

pietra turchina, or *columbaria*, now and then are found veins and nodules of coals.

4. *Cava di Pietra arenaria nel Giardino di Boboli.* The high hill, on which this garden is situated, is towards the plain of the Palace Pitti, by nature cut off and shaggy. It is here that they dig a yellow sand-stone, which is employed in building. But under and above this sand-rock is *pietra forte*; accordingly this hill is distinguished only by this accidental sand-bed from the other Florentine-hills; which, upon nearer enquiry, might offer the same phænomenon. The visible beds in this hill are from the surface to the depth as follows. 1. Many thin beds of petrified clay or marle, that is to say, *Bardelloni* and *Pietra forte bigia*, which alternate, but are too thin to be employed in pavings; on the surface likewise marked by spar-lines which are rhomboïdes. 2. A bed of yellow sand-stone, mixed with some lime; therefore acted upon by acids; and proper for building. 3. *Pietra forte turchina*, or *columbina*.

5. *Montagne di Gabbro intorno Impruneta*; seven Italian miles distant from Florence towards the South. The hills about *Impruneta* consist of Gabbro or Serpentine-stone, commonly thereabout dug out of several hills, and employed in the floors and decorations of palaces and churches, as may be seen, for example in the church of the beautiful

tiful and great Carthusian Monastery, three miles distant from Florence. But I have some very good reasons to suppose this Gabbro, near *Impruneta*, to be superincumbent on limestone; for beyond this monastery arise found limestone-hills, which you ascend, till within a mile from *Impruneta* you reach the Gabbro, on which you ascend further up to *Impruneta*. On the hill where this place is situated, behind and sideways of it, they have occasionally sunk a pit in the Gabbro, and found under it a grey compact limestone with pyritical nodules. Not far off, in another pit, they have discovered a remarkably large stratum of clay of a blueish-grey or yellowish, which dips between forty-five and seventy-five degrees, and furnishes the potters at *Impruneta* with the materials for their pottery; which consists of great vases, and gets reddish in the fire. The singular situation of this clay in and between the Gabbro, together with its different mixtures, cause several opinions on its origin. It is somewhat mixed with lime; accordingly it is of the marl-kind, and it is acted upon by acids. This is probably owing to the inferior lime. The reddish colour, when baked, may be ascribed to a mixture of iron particles of the pyritical nodules in the limestone. The small pieces of selenite offering in this clay may have been

produced by the connection of the pyritical sulphureous acid with the calcareous earth. But, a great quantity of talc-glimmer, and even many pieces of Gabbro offering in this clay, which besides is uncommonly fat and talcous to the touch, there is no doubt of its containing a good deal of talcous Gabbro or Serpentine-earth. Has not therefore this clay a share in the composition of Gabbro or Serpentine? Their natural affinity of external qualities, and their now-described birth-place and situation, together with the experiments of Doctor *Stange* *, seem to countenance this opinion and the generality of Mineralogists, who hitherto have ranked the Serpentine among the argillaceous stones. However, I am very well acquainted with the experiments of the justly celebrated Director *Marggraf* at *Berlin* †, according to which the Gabbro or Serpentine contains a particular alkaline earth, the very same which is visible

* This gentleman is at present Professor of Chemistry at Wurzburg, and has published his Experiments in a Dissertation printed at Franckford on the Oder.

† See his Demonstration of the alkaline parts of common salt being an alkaline salt. Tom. I. of his Chemical Works. Analysis of the evaporated brine and its earth. Ib. Tom. II. Experimental Demonstration of the Serpentine-stones not being of an argillaceous kind. Ib. Tom. II. Account of the effects of vitriolic acids on several species of stones and earths. Ib. Tom. II.

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ble in the evaporated common ſalt-brine, and by a mixture of vitriolic acid produces the bitter purging or cathartic and Epſom-ſalt. Should not there be a means to reconcile theſe two different opinions?

The Impruneta-Gabbro or Serpentine is white, red, black, yellow, and green; either of the ſame colour or variegated, ſuch as yellow and red-veined, black and red, green and yellow. All theſe varieties are found and compact, croſſed by ſmall aſbeſt veins, and are frequently ſprinkled with a greeniſh argentine fat talcous glimmer, which is cubic as the horn-blende, but friable into a fattiſh duſt. In the perpendicular or oblique fiſſures of this Gabbro, which were broad from ſix to twelve inches, I found the following varieties:

1. White and looſe ſoap-ſtone, or lebes-earth.

2. Green ditto.

3. White compact ſoap-ſtone, or Serpentine, ſeemed but a petrifaction of the white lebes-earth (*n.* 1.) being either ſtill friable or entirely petrified as the Briançon-chalk.

4. Green compact Bacon-ſtone, produced and differenced as *n.* 3. by the petrifaction of *n.* 2.

5. Fibrous Bacon-ſtone or Gabbro, reſembling Amiant, either white or green, either coarſe or fine fibrous. This fibrous Serpentine may be, I think, conſidered as unripe Amiant. Between the coarſer

fibres there appeared veins of white calcareous ſpar, which was acted upon by acids; but in ſome places it was ſo entirely petrified into the nature of feld-ſpath, that it reſiſted acids as well as the friction of iron.

6. White Amiant, more or leſs fine and aſbeſt-like.

7. Green Amiant, ſcarce.

8. White and dry Amiant-earth, or remains of deſtroyed Amiantes.

The Gabbro-hills near *Impruneta* contain horizontal beds of *Granitone*, conſiſting of much white feld-ſpath, which is in ſome places calcareous, of ſome greeniſh argentine cubic glimmer, and of greeniſh Serpentine-earth. I ſaw in Mr. *Targioni Tozzetti's* collection, who accompanied me to *Impruneta*, ſome pieces of *Granitone*, which had been found there, and were entirely deſtitute of glimmer, conſiſting of large white parallelopipedons of white feld-ſpath, and a glue of green Gabbro-earth. The greeniſh argentine and cubic glimmer of this *Granitone* is friable into a fat talc-powder, and appears in the maſs of the ſtone in oblong parallelopipedons, compound of lamellæ or ſmall cubes. The *Granitone*-beds in the Gabbro-hills near *Prata* are ſo large, that they cut them into mill-ſtones.

LET-

LETTER XX.

Florence, June 1, 1772.

I OWE you ſtill the deſcription of my journey from *Bologna* to *Florence*. Having got the neceſſary informations, eſpecially Count *James Cronſted's* obſervations, which, in Mr. *Guettard's* company, he made on that road, and has communicated to me, I will now diſcharge my debt.

The road from Florence to Bologna is generally aſcending to *Monte Traverſo* and *Pietra Mala*; but thence ſloping towards Bologna. *Monte Traverſo* conſiſts of lava produced by an ancient volcano. Next to *Florence* and *Bologna* are argillaceous, ſhivery, micaceous, or macigno and marl-hills, uncovered and bare. But higher up, the grey limeſtone of the Apennines is ſuperincumbent on them in large beds, now and then ſeparated by ſmaller marl or clay-beds. All theſe argillaceous, micaceous, and marl-ſtrata, on both

ſides of the Apennines near *Florence* and *Bologna*, together with the ſuperincumbent calcareous ones of the Apennines, are in an oblique poſition dipping from the South-eaſt towards the North-weſt; that is to ſay, towards Florence they are riſing above, and towards Bologna they are dipping underneath the ground. Probably they have been in the beginning in an horizontal poſition, and got an oblique dipping by the eruptions of the ancient volcano at *Monte Traverſo*, raiſing the beds on its Northern ſide, and ſinking thoſe to the South, perhaps by deſtroying the combuſtible ſubſtances by which they were ſupported before. Count *Cronſtedt* aſſerts never to have met with any marine petrifactions in the grey compact limeſtone of the Apennines; but herein he is certainly miſtaken, having perhaps intended to ſpeak of the cryſtalline and ſcaly limeſtone; ſuch as that at *Carrara*. I have myſelf conſtantly found petrifactions in the grey limeſtone of the Apennines and ſeveral other Alps; though ſometimes they are very ſcarce, and to be found only by careful enquiry. Some Alpine-beds, it is true, may be deſtitute of petrifactions; but then other ſtrata of the ſame Alp will be the more filled with them.

Two miles diſtant from *Florence*, near the village *Bobera*, riſes a hill, conſiſting of mouldering argillaceous ſlate, micaceous ſhiſtus and macigno, ſtratified;

tified; which, as all the following, dipped from S. E. to N. W. in nearly twenty-three degrees. The ſummit or back of this hill was plain and flat. Here is a tile-manufactory, in which the before-mentioned mouldering and ſhivery clay is baked. This hill continued gently aſcending: two miles nearer *Creica*, I ſaw fragments of coarſe calcareous ſpar in the argillaceous ſlate, its ſmall beds by different mixtures coloured black and red; theſe red-coloured ones broken in regular oblique cubes or rhomboïdes. There appeared in it ſmall and accidental beds of yellow ſeparated limeſtones, covered with dendrites.

Soon after the ſhivery argillaceous ſlate, ceaſing to be micaceous, alternated with large grey limeſtone-ſtrata. Theſe hills continued to the left, and roſe very high. They go under the name of the Apennine Alps; which accordingly conſiſt of large beds of grey and compact limeſtone, now and then, but not generally, ſeparated by ſmall argillaceous ſtrata. They are never found in the higheſt mountains. The road going ſideways from theſe higher mountains, I travelled along a little brook, eight miles farther; where I obſerved, in the calcareous ſtrata, fiſſures filled and healed up again by cryſtallized ſpar. The ſame ſpar offered in the argillaceous beds in lumps and nodules. The road

road went over such a clay-bed in a plain and horizontal direction,

Four miles to *Cajanello*; where it generally ascended over a long ridge of hills, which being entirely cloathed with shrubs and bushes did not appear stratified; but offered rubbish and separated fragments of marl-slate and clay, with some mica.

This rubbish continued fourteen miles to *Monte Caravalla*; where a steep and bare hill offers some beds of a coarse clay, mixed with lime or marl-stone, which inclosed mica and irregular broken pieces of macigno. These beds are in an oblique dipping position, opposite to that before-mentioned, which, appearing but for a short way, is a mark of an accidental convulsion; which

Two miles farther has happened in *Monte Traverso*.

This hill lies across the ridge of the Apennines, is extremely steep, split from top to bottom, and consists of black-greenish grey spotted lava. Among the many scattered separated stones, which are remains of the old eruptions, I found numbers of large limestones. Beyond *Monte Traverso* towards *Bologna*, the grey limestone-beds appear again in their general dipping position.

From *Monte Traverso* the road ascended somewhat during four miles to *Pietra Mala*, on whose summit

ſummit is a flat, which is ſurrounded with ſome hills. On the ſloping ſide of ſuch a hill towards the valley, appear continual flames; which being ever to be ſeen, have cauſed this hill to be called *Pietra Mala*. The calcareous Apennines are to the left. The flaming place is covered with earth, and looſe ſeparated lime, clay, and marl ſtones. Every circumſtance ſpeaks a violent devaſtation. The whole is ſurrounded with graſs and corn. The flaming place has properly but ſix feet diameter, and the flames appear between and upon the before-mentioned ſtones. The marl and clay-ſtones are hardened by them. The calcareous ones are rather calcined and diſſolved. The flames are exceedingly clear, and yellowiſh-white as ariſing from burning oil. They have a faint ſmell of petroleum, and depoſit by its conſumption a fine ſod upon the ſurrounding ſtones. They riſe about two feet above the ground, give no mark of any ſulphureous acid, grow ſtronger after wet weather, and fainter in dry ſummers. This I was aſſured by the neighbouring people. Among the looſe ſeparated ſtones of this place I obſerved fragments of Serpentine-ſtone * and calcareous porus or tophus.

* Mr. *Guettard* has found likewiſe Gabbro or Serpentine-ſtone in an old extinct volcano between *Rome* and *Loretto*. Tho' I mean not hence to draw too raſh or falſe concluſions of this ſtone's

Somewhat higher in the valley, but on the ſame ſloping ſide of the hill, is another funnel of burning petroleum. It is of a larger circumference, but the flames ſo faint, that they are ſcarce viſible by day-light. Farther on, at the end of the valley, where the ground aſcends to the higheſt ſummit, is a ſmall pool, called *Aqua Buja*; whoſe water, though cold, ſeems for ever boiling, on account of many air-bubbles which riſe from its bottom. Its ſurface is covered with bituminous oil, which catches the fire of any approaching candle or flambeaux, and continues burning till wind or rain quench its flames. All theſe curioſities are within a circumference of about one Italian mile and a half. The higheſt ſummit of the Apennines, which I mentioned before, conſiſts of reddiſh limeſtone beds, covered by large ſtrata of a coarſe grey limeſtone, and dipping as commonly in twenty-five degrees.

This coarſe grey limeſtone continued and alternated with marl-ſlate till I came to *Dojano*, at the diſtance of ſix miles, where appeared ferruminated or glued beds of blunted quartz-pebbles and detached lime-ſand, and argillaceous ſlate pieces. Superincumbent to theſe I found firſt marl-ſlate,

ſtone's being a volcanic production, I have, however, noticed this obſervation, ſince no phænomenon in nature ſeems to me indifferent.

and

and afterwards fine white-grey lime-mixed sand-stone, and dark-grey compact stratified limestone.

Five miles farther, at *Livergnano*, the white-grey sand-stone was covered with marl-beds and blunted straggling limestones, of a different bigness and colour; containing a great number of petrified shells and corals. Alternating with and above them occurred beds of a coarser limestone, in a more and more horizontal situation. The lower I descended in the plain, the greater the variety of the strata, which appeared shorter, and to be produced by several accidents, not to be observed in the higher and more regular hills; which, for that reason, seem to be of greater antiquity, and of a different origin.

Five miles farther, at *Pianura*, the former white-grey sand-stone appeared again; lower hills continued into the plain, which begins eight miles off, at the gates of Bologna, and connects with Lombardy. I saw on both sides of the road large erected stones of a coarse selenitic mass, which is dug at *S. Rosilo*, and proves that there has been formerly in these parts many solutions of calcareous stones by vitriolic acids; whose concomitant heat and fermentation have probably produced many effects, which we cannot explain.

I have made, at *Rome*, *Florence*, and *Bologna*, a meteorological observation, which seems to have some

ſome foundation in Natural Philoſophy, and to be worth your attention. The *Scirocco*, a wind which blows from the ſea, occaſioned laſt winter at Rome conſtantly rain and cloudy weather; but the *Tramontana*, which blows from the hills, brought fair weather. In ſummer, after the month of April, it is exactly the reverſe. The cauſe ſeems to be, that the ſea, being in winter warmer than the air, evaporates in that ſeaſon more than in ſummer. Moreover, the hills are covered in winter with ſnow; accordingly they cannot evaporate; but in ſpring and ſummer, as ſoon as the ſnow thaws, and in many rapid brooks ruſhes down in the plains, they are ſubject to ſtrong evaporation. When I went from Rome by Siena to Florence, I had rain and *Tramontana*; but on the other ſide of the Alps they had the ſame wind and fair weather. Nearly the ſame time there was fair weather at Ancona, and ſome rain at Bologna, probably becauſe that place is ſomewhat nearer to the Alps. There never is in ſummer any rain at Florence, except after *Tramontana*, or North-wind in the morning.

But no more of Florence. I am reſolved to go hence to Piſa, Leghorn, and Genoa. This deprives me of the opportunity to ſee *Lucca*, *Parma*, and *Modena*. Of theſe places therefore I ſhall only tell you what I have been told myſelf.

There are at *Lucca* some hot wells, described by *Jo. Bapt. Donati*, Libri iv. *De aquis Lucensibus*; but best by Professor *Giuf. Benvenuti's* treatise, *De Lucensium thermarum sale*; printed at Lucca, 1758, 8vo. You know that they have undertaken at Lucca a new impression of the French Encyclopedie, with Supplements and Annotations. Here is published likewise a Literary Review, under the title of, *Memorie di Fisica di Lucca*.

At *Parma*, the collection of Natural Curiosities, belonging to the Duke, is said to be worth seeing. It is under the inspection of the learned P. Fourcaud. The Duke's Librarian, P. Paciaudi, is a man of great learning.

At *Modena*, the Duke's Librarian, *P. Zaccaria*, is a learned Jesuit. Between this place and Lucca there is a new road making over the Apennines. *P. Boscowich*, who formerly lived at Modena, has published some account of this road, and of several mineralogical observations. The *Salsa di Modena* is a remarkable swamp in the hills near Sassuolo; where the new road is making over the Apennines to Massa di Carrara. It seems to be the exterior or upper covering of a volcano, which is said to throw out sometimes earth, pyrites, and large stones. A pole may be driven or forced into it to

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the depth of a fathom; being taken out, the water ſprings with violence from the hole which it had produced. Somewhat higher, following the new road to the inn called *Il piano del oglio*, there are a great number of pits, in which they gather petroleum ſwimming on the ſurface of the water. *Ramazzini* and *Valiſneri* have deſcribed the *Salſa di Modena*. *Arioſto*, a relation of the poet, has likewiſe deſcribed it in a performance inſerted by *Ramuzzini*. Wells may be dug and found in any place of the Modaneſe. *Ramazzini's* treatiſe *De admiranda fontium Mutinenſium origine*, Mutinæ, 1691, 4to. is worth peruſing. In the hills near *Vignola*, and in ſeveral other places of the Modaneſe, they find red agates, cornelians, and different ſorts of jaſper, which are exported to Milano. There are alſo ſome copper-mines in the Apennines belonging to this country, eſpecially *Alle Pievi di Reno al Veſolo ed all' antico caſtello di Medola nella provincia Grafagniana*. Hills of Gabbro or Serpentine not wanting.

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LETTER XXI.

Leghorn, June 9, 1772.

BETWEEN Florence and Piſa the road goes to the left of the Arno on the ſloping of high mountains; which conſiſt firſt of macigno, and afterwards of black and blueiſh-grey limeſtone, in large beds. The hot wells of Piſa, remarkable for their fine ſituation and magnificent buildings, ſpring in theſe calcareous hills. They are deſcribed by ſeveral authors. The beſt and moſt modern are, *Cocchi's Diſſertazione ſopra i bagni di Piſa.* 4to. *Trattato de' bagni di Piſa del D. Giov. Bianchi.* Firenza, 1757, 8vo. *Analiſi delle acque thermali de' bagni di Piſa fatte dal D. Bartolomeo Meſny.* Firenza, 1758, 8vo.

Mr. *Targioni Tozzetti* has told me, that near the road between Florence and Piſa ſome upper ſtrata in the hills conſiſt of Breccia, which ſometimes contains holes with earth or duſt. The hills towards the ſea, near Piſa, are ſaid to conſiſt of

marl, and sometimes to contain a species of *lusus naturæ*, resembling trees or branchy corals, with round buttons like apples sticking to the branches. They are neither petrified plants nor corals, but accidental concretions of marl, produced like stalactites within the marl-hills.

The University at Pisa is distinguished by many learned Professors. There appears at present a Literary Review, under the title of, *Giornale de' Letterati di Pisa.*

The Observatory *(la Specola)* at Pisa is a fine building. The Professor of Astronomy, Mr. *Tomaso Perelli*, and his substitute Abbé and Dr. *Slop*, have a reputation, which their learning justly deserves.

The Botanical Garden is spacious, and kept in good order. The Professor of Botany and Natural History, Dr. *Tilli*, lives in it; and has published *Hortum Pisanum*, in folio. To his care is likewise intrusted the academical collection of Natural Curiosities, kept in a fine saloon. The late celebrated *Steno*, author of a treatise, *De Solido intra Solidum*, laid the first foundation of this cabinet, augmented at present by the valuable collection of shells, belonging formerly to the late Dr. *Gualtieri* at Florence. He was physician of the court, and had the permission to appropriate to himself the duplicates of the Grand-Duke's Gallery,

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into which the cabinet of Rumphius had been inserted. I noticed, among many other curiosities,

1. A human skull, incrustated by a marine animal production, called *Porus cervinus*, with a piece of branchy coral sticking to it; fished up from the bottom of the sea; and incrustated with these coralline substances, as bottles and other things are commonly used to be; remarkable as being the same which Gassendi has described and drawn.

2. Petrified corals or lithophytes in common flint *(silex)*, from the University of Oxford.

3. A ring of quartz-crystal, set in gold; containing a hole, half-filled with water, in which a small insect is observed swimming. I have convinced myself, by repeated close examination, of its being really an insect; which I doubted at first sight.

4. A large fine-green emerald, in a perfect columnar sherl-form, in quartz *.

5. Yellow round pebbles, from the Nile, called *Cailloux d'Egypte*, hollow, and within incrustated by small quartz-crystals.

6. Fallow copper-ore, from some ancient mines near Seravezza in Tuscany.

* The like to be seen in the British Museum, formerly belonging to Sir Hans Sloane.

7. Cinnabar-ore, from the ſame place.

8. A large petrified echinites, compreſſed into an oblique form by the ſuperincumbent weight of the ſtratum in which it was found.

9. A large turtle-ſhell, with longitudinal ſtripes, reſembling the *Buccinum Harpa*.

The Profeſſor of Chemiſtry, Mr. *Nicola Branchi della Torre*, has of late begun a collection of minerals and chemical preparations, chiefly intended for his lectures.

The road from *Piſa* to *Leghorn* goes, 1. near the before-mentioned calcareous hills. The land afterwards becomes, 2. plain, and is covered by a browniſh ſea-ſand, which continues towards the ſhore; but, 3. five miles on that ſide of Leghorn is *monte Nero*, where a white ſoap-ſtone *(ſmectis*, Italian *pietra di Sarto*, becauſe employed by taylors for drawing) is digging. 4. Near the ſhore at Leghorn, are ſome hills, conſiſting of a grey or rather grey-yelloviſh calcareous tophus, which is filled with ſmall microſcopical ſhells and lithophytes. The waves of the ſea diſſolve theſe ſtones, which cauſes theſe ſmall ſhells to be mixed with the ſea-ſand, in which Abbate *Fontana* has found theſe microſcopical lithophytes, and ſome lituites. In a quarry of a ſimilar tufo, near the hoſpital *S. Jacopo* at Leghorn *(cava di S. Jacopo)*, are found plenty of greater Bucardites.

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There are ſeveral coral-manufactories at Leghorn. The red corals fiſhed near Sardinia are ground there to beads and necklaces. They are belonging to ſome ſubſtantial Jews, and have been exactly deſcribed in the *Giornale d'Italia*. This trade demands a great ſtock, and is carried on chiefly with the Indies, Turkey, and Barbary. Some of theſe beads and ornaments are ſold in Italy and Germany. At Bologna, the girls wear commonly red coral necklaces.

Dr. *Giovanni Gentili*, phyſician to the *Officio della Sanità* at Leghorn, has publiſhed the following works: *Oſſervazioni ſopra i terremoti ultimamente accaduti a Livorno.* Firenze, 1742, 4to. *Annotazioni ſopra il commerzio del oglio.* Firenze, 1754, 4to. *Sitologia ſeu de plantis frumento ſuccedaneis.*

The French Encyclopedie is printed at Leghorn, and is a fine edition, with Supplements and Notes. This edition is carefully ſuperintended by the learned Abbé *Seraſini* and Dr. *Gonnella*. It ſeems to be ſuperior to any other.

The trade of Leghorn is remarkably extenſive. Though the neighbouring iſland Elba produce plenty of iron, there is, however, much Ruſſian and Swediſh iron, in bars, imported. But the coarſeſt Swediſh iron goes by Leghorn into Bar-

bary; the fineſt being exported to England; and the middle ſort to Germany, Holland, and France.

The iſland *Elba* is remarkable on account of its iron-mines. It is the property of the Prince of Piombino, under an annual recognizance of a certain quantity of iron-ore, to be delivered for the Grand-Duke to Porto-Ferrajo. The mountains of this Iſland conſiſt of Granite, which partly is violet and very fine, becauſe its feld-ſpath forms large oblong ſquare cubes of a violet colour. It is employed in the pedeſtal of the Equeſtrian ſtatue before the *Santiſſima Annonziata* at Florence, with this inſcription, MAJESTATE TANTUM; and in the under incruſtations in the famous *Capella di S. Lorenzo*. The ore is not found in veins, but in a large hill or maſs of ſolid ore, ſurrounded with Granite-mountains. For that reaſon they dig it not in expenſive mines, but in open quarries. It is a fact, that ſeveral mountains in Sweden, Lapland, and Siberia, likewiſe entirely conſiſt of iron-ore; and ſome hills in Campiglia, and other places in Tuſcany, are either entirely, or in a great meaſure, of the ſame nature. Branches of theſe iron-maſſes continue running between the hills of *Maſſa di Maremma*. The ſimilarity of the ores, and of their running, gives ſome probability that the Tuſcan iron-hills are but branches of the large iron-maſs in Elba, being to be conſidered a

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its continuations under the level of the sea; which is the more credible, as the sea carries constantly to the shore a great quantity of separated pieces of the same iron-ore. The iron-mass or stock at Elba consists, for the greatest part, of a sound iron-coloured ore, being either an iron-coloured hematites (*Cronst. Min.* § 201.) or magnetic ore (*Ib.* § 2. 10.), or load-stone (*Ib.* § 209.) which is now and then found to be very good. These different sorts of ore crystallize in the holes and fissures into different forms; as that of stalactites, polygones, cellular crystallizations, or lamellated and glimmery ones; such as iron-glimmer or eisenmann. The finest samples of all these species of ore are to be had from that island, the ore itself being of the same goodness as the Swedish: but the Italians are greatly deficient in its melting and preparation, as I have observed in the iron magazine at Florence. In the substance of the ore offer now and then some pyrites in cubic or polygone marcasitical crystals, some copper-pyrites, whith amianth, wolfram, and great quantities of white, liver-coloured, and red bolus, which is found in large long-stretching fissures, that might be called veins. Part of these boles appear sometimes to be petrified into jasper. I have seen likewise stalactites from this island, either consisting of brown iron-ocher, or of an iron-coloured substance. The ores are from

Isola d' Elba exported into several ports of the Roman and Tuscan dominions, and sold there to the proprietors of the furnaces.

The island of Corsica, and its natural productions, will be, I fancy, nearer examined by its present possessors. Mr. *Barral*, a French engineer, with whom I got acquainted at Naples, has assured me that there are Granite-mountains; and that some other hills seem to be metallic ones.

The *Verde di Corsica* is no marble, but a hard rock, striking fire with steel, of a white substance, with blackish or violet spots, and large grass-green sherl crystals, of a sweet colour. Large tables of this fine stone to be seen in the *Capella di S. Lorenzo* at Florence.

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LETTER XXII.

Genoa, June 16, 1772.

I CAME from Leghorn to this place by water along a ſhore, which not only offers a great many picturesque and agreeable rocks and landſcapes, planted with olive-trees, but is likewiſe remarkable on account of Maſſa di Carrara, Seravezza, Porto Venere, Seſtri di Levante, and Lavagna. I went but now and then on ſhore. I ſhould have wiſhed to make the whole way by land, but the accounts of its nature checked my eagerneſs. The whole ſhore conſiſts of high towering calcareous rocks, extremely ſteep towards the ſea, and equally rapid towards the land. On the top of this ſtrait ridge is a foot-path, running over ſeparated looſe ſtones, and ſo very ſmall, that the ſtumbling of the mule would throw one down into the ſea, or over the tremendous precipices on the land-ſide. Every rain produces in the deeper ravins of theſe hills violent and rapid torrents,

torrents, which ſtop or make dangerous the paſſage till they diſappear again. Add to this, that along this road there are but few and thoſe very poor inns to be met with, and a people whoſe tenderneſs of conſcience is not at all remarkable; I fancy, therefore, you will not diſapprove my going by ſea.

Carrara is ſituated on one ſide, and *Seravezza* on the other ſide of the ſame mountain. The grain of the Carrara-marble is cryſtalline and ſcaly; that of Seravezza is finer, though it be of the ſame origin, and in the ſame ſituation, as the former. The Carrara-marble is either milk-white, and then it is much reſembling the Parian antique marble; or it is grey, and then called *Bardiglio* or *Bigio di Carrara*. If there be micaceous ſtripes acroſs the white or grey, as in the Greek *Marmo Cipolino*, it is called *Cipolinaccio di Carrara*. The Seravezza-marble is white, purple-mixed, and extremely beautiful. There are ſeveral varieties, which go under the names of the ancient marbles, of nearly the ſame colours; ſuch as, Fior di Perſico, Pavonazzo, Africano, Africano Fiorito, Miſchio di Seravezza. Sometimes the white and purple-ſpots are ſo exactly ſeparated, that the marble reſembles a calcareous Breccia; in which caſe, it is called Breccia di Seravezza, though properly it ſhould be called Brocatello. Sometimes it is black ſpotted.

The marble of Carrara and Seravezza, and gerally the cryſtalline, ſcaly, and coloured marbles, ſuch as thoſe in the Saneſe and Genoeſe, near Porto Venere, &c. are found in large maſſy oblique ſtrata, ſuperincumbent to each other, and, as far as we know, entirely deſtitute of petrifactions. Every ſtratum has its particular fiſſures, which commonly are filled with calcareous ſpar, and ſometimes with quartz. At Seravezza the deeper laying ſlate *(Saſſo morto)* appears under the ſuperincumbent marble.

The *marble* of *Porto Venere* in the Genoeſe is yellow, mixed with black, and extremely beautiful.

Near *Seſtri*, and in ſeveral other places, are different coloured marbles.

At *Lavagna* they dig black table-ſlate, which ſerves at Genoa, and thereabouts, inſtead of tiles. It is employed likewiſe in the linings of oil-ciſterns; and is preferable to the common incruſtations of lead or plaiſter, ſince the acid in the oil acts upon the lead, and even upon the plaiſter, if it be not entirely ſaturated with the vitriolic acid. This ſlate is, in Italy, called *Lavagna*, on account of the place in which it is found.

Near *Polzevera*, in the Genoeſe, is digging a ſort of rock, known under that name, conſiſting of

of Gabbro or Serpentine, croſſed with calcareous ſpar-veins. It is red and green. But there are beſides ſeveral places in other parts of Italy where the ſame is to be found.

The hills near Genoa conſiſt, toward the country, of a ſort of macigno; and beyond Genoa, on the ſea-ſhore and the road to Turin, of grey and blackiſh limeſtone.

There is ſcarcely any thing to be ſaid of Genoa in reſpect to Natural Hiſtory. It is a commonwealth of merchants, more fond and curious of gain than of plants and ſtones. Dr. *Roſini*, phyſician to an hoſpital at Genoa, is the only Botaniſt whom I have found there. He ſtudied at Montpelier, and keeps for his diverſion a little garden, with ſome plants. I ſaw here ſome native gold in ſmall ſeparated lamellæ, ſaid to be waſhed from an ore, found twenty miles diſtant from Genoa in the mountains. The city is built with much magnificence, but too cloſe ſurrounded with hills; which, however, makes the climate as ſoft as that of Rome. The proſpects, the ſhore, and the landſcapes hereabout, are unparalleled.

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LETTER XXIII.

Turin, June 30, 1772.

THE tract of land between Genoa and this place conſiſts of the following varieties of mountains and hills.

1. Behind Genoa, grey and blackiſh limeſtone.

2. The hills of the *Bochetta* conſiſt of black undulated ſlate, green Gabbro or Serpentine-ſtone, polzevera or gabbro with calcareous veins, argillaceous ſlate, glimmery and ſplendent as fiſh-ſcales; and finally, of grey limeſtone. Theſe ſtones alternated without any ſenſible order in the ſituation; and it ſeemed as if, in the ſame hill, one part conſiſted of ſlate, another of Gabbro, and another of limeſtone. This ſeems to confirm that clay is a conſtituent part of Serpentine or Gabbro, which differs from the ſlate and its clay but by a mixture of ſeveral other particles. The calcareous veins in the Gabbro produced the polzevera near the adjacent limeſtone. Some parts of the green Gab-

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bro are mixed with a talcous glimmer; for the greateſt part it is fat to the touch, as that of Impruneta; but ſome there is entirely dry, and cloſely ferruminated with flint; hence extremely hard, and exactly reſembling a ſea-green jaſper. All theſe hills are richly grown over with cheſnut-trees, very high and very agreeable. They terminate near *Nori*, and from that place the country becomes plainer.

3. Near *Ottacio*, and even to *Alexandria*, the country is covered with white hills, appearing on the ſides of different rivers in oblique ſtrata, probably produced by theſe rivers in former times, and conſiſting of a fine hardened marl, mixed with glimmer and ſmall blunted pieces of Gabbro. Theſe hills run far beyond Alexandria, though they do not appear there remarkably elevated, but form rather a plain well-cultivated country. Some of them contained blunted detached limeſtones, in ſo great a quantity, that they made them reſemble a ſort of Breccia or Pudding-ſtone.

4. Somewhat further near *Aſti*, in a valley, a bed of black loam or common clay appeared, on which ſomewhat higher is ſuperincumbent the beforementioned glimmery marl, in which hereabouts frequently offered fragments of marine-ſhells, eſpecially of a kind, which is called Solen. This plain country, and theſe marl-hills, continue

to

to Turin; nay, beyond that place to the foot of mount Cenis, a calcareous Alp. Of that nature is likewiſe the whole country, and all the hills of Piedmont. Blunted rolled pieces of Gabbro, and ſome petrifactions of marine bodies, are frequently found in it. But beſides theſe there are other hills in Piedmont, calcareous and quartzous ones, which are veined with ſmall ſtripes of mica. Such are the hills next to Turin; and that ſort of ſtone is called Sarris, commonly employed in foundations and columns.

The Arſenal at Turin deſerves the attention of a friend of Natural Hiſtory and Chemiſtry, becauſe it contains a collection of minerals, a good chemical laboratory, a library of mineralogical and metallurgical books, and well-directed furnaces for caſting guns. As chemiſtry is of great uſe in the artillery, and the principles of mining may prove highly uſeful to a part of military architecture, the court has been induced to make theſe uſeful eſtabliſhments in the Arſenal, which are calculated for the inſtruction of engineers as well as for that of young miners. I need not tell you, that there is no want of maſters in the mathematical, mechanical, and other arts relating to tactics; but I ſpeak only of what is to my purpoſe.

The Cavalier *Rubilante* was ſome years ago ordered by his Majeſty the King of Sardinia to make

and

and to ſuperintend theſe uſeful eſtabliſhments. Some time before, he had travelled at the expence of the King with three young gentle men to Germany, and eſpecially to Saxony, to get there, and in the Miners-academy at Freiberg, that knowledge by which he and his companions were deſigned to be uſeful to the public. You remember that counſellor *Gellert*, in the Preface of his Metallurgical Chemiſtry, has taken proper notice of theſe travellers. At their return, Cavalier *Rubilante* got the commiſſion of the eſtabliſhment, the inſpection and chair of a Profeſſor in this Mine-academy, together with the direction of the mines in Savoy. He cauſed ſome of them to be worked again; and during ſeveral years he continued in theſe different functions with great advantage to his diſciples. One of his companions was ſent into Savoy, and the two others into Sardinia, to examine the mountains and mines of this remarkable country. A happy moment in the Natural Hiſtory of theſe parts; as about the ſame time *Donati* ſpread a new light in ſome other parts, and was entirely bent on bringing Arabian treaſures into Europe! I ſhall preſently take more notice of this unhappy man. But how vain are human hopes! *Donati* fell a ſacrifice to the plague; the unwholeſome air killed the two travellers in Sardinia; another diſeaſe made away with the third ſent into Savoy,

voy, and *Rubilante* found many reasons to prefer retirement; which, proving agreeable and happy to a philosophic mind, deprived the state of an useful member, and the Sciences of an active friend. Happily he had formed by his instructions a man of great merit, who is his successor. This is Mr. *Grasion*, an artillery-officer. By his commission he is obliged to go often into Savoy, and might give many curious observations on the nature of the mines and mountains of that country. The collection of minerals under his inspection contains many remarkable pieces from the German and Saxonian mines, together with some minerals and petrifactions from Piedmont, Sardinia, and Savoy. Unhappily the number of these last is the less considerable; as but few mines are still working. I shall take notice of some.

1. Native gold in quartz, from *Valle d'Aosta nelle valle di Chialland*, in Piedmont. There are in these parts several considerable quartz-veins, with plenty of native gold, of fine-grained lead-glance, containing some silver, of pyrites, and fallow copper, and silver-ore. The quartz is sometimes crystallized, which appeared by several crystallizations penetrated and tinged by copper-azure. The brooks, which from the mountains run over these quartz-veins, commonly wash down

large and rich gold-quartz pieces, entirely similar in bigness and riches to those of the Guinea-coast. I saw in this collection found pieces of native gold in quartz, nearly of the bigness of a fist, with some smaller ones, found in the torrent called *Evanzone*. Mr. *Rubilante* had revived the ancient works of the Romans in these veins; but after his retirement they were dropt. 2. Red antimony, from *Chailland* at *Valle d'Aosta* in Piedmont, so much resembling that of Braunsdorf in Saxony, that I rather incline to believe it to be a Saxonian sample. 3. Green lead-ore, from *Darba* in *Valle d'Aosta*. Of this kind, I saw some years ago, in the collection of Chevalier *Turgot*, at Paris, several fine samples uncrystallized, found, glossy, nearly transparent, and of the colour of high-green or a dark-green lead-glass.

4. Some gold-ores and fallow silver-ore, from *Dallangua*, in *Valle di Sexta*, in *Piedmont*.

5. Pyritical and other copper-ores, from the same place.

6. Several silver-ores, with cobolt, from *Bourg d'Eauecan*, in *Dauphiné*, near *Briançon*.

7. Cobolt, from some mines still working in Piedmont and Savoy. The burnt ore is transported, and sold at Nurnberg.

The University at Turin has, in the noble academical buildings, a considerable library, a good cabinet

cabinet of antiquities, and a collection of natural curiosities, which is in no sort of order. It consists, 1. of a collection of shells and English minerals, which the King bought from his physician Count *Carburi*, at present living at Paris. 2. A collection of fine antique and modern polished marbles and hard stones, petrifactions, corals, zoophytes, and some minerals, made by the celebrated *Vitaliano Donati*, in his voyages into the Adriatic sea, before he went to the East. The King bought it, for the University, of *Donati's* heirs. 3. Some chests of natural curiosities, which *Donati*, during his travels in Egypt and Arabia, sent from Goa by the way of Lisbon. They contain a great quantity of dry plants, undescribed and unexamined; some antiquities, inserted already in the collection, and a great number of insects, corals, shells, and marine productions. A great number of these corals, shells, and marine productions, being very common in the Mediterranean; and, upon the whole, not at all answering *Donati's* abilities, and the countries from whence he sent them; there arises a probable suspicion, that these chests have been opened and robbed before their arrival at Turin. They were a long time on the road, and afterwards a long while deposited at Lisbon, unknown to the court of Turin, till at last Professor *Vandelli*

gave advice of their arrival. Besides, there appeared not in these chests any accounts concerning Natural History, except some notes of the plants which he had sent before; with some fine memoirs on the antiquities of the countries in which he travelled, and in which he was very conversant.

This unhappy man was born at Padua. He had an uncommon inclination to Natural History. Fired by the activity of his genius and the quickness of his understanding, possessed of an extensive knowledge of the sea-productions, and blessed with a good constitution, he was prompted in the bloom of life to so hazardous an undertaking. His qualities procured to him, first, the place of Botanic Professor at Turin, and afterwards the commission of the literary expedition, which, had he lived, would have undoubtedly proved a great advantage to science. He was not eminent in botany, at least when first he was denominated Professor of botany. This appears by many wrong denominations given by him to the coloured drawings after living plants, which are kept in the academical library, and are still augmenting. But it is equally true, that afterwards he bent with great application to this part of science. It would be unfair to expect that any man should have an equal knowledge in every part of the extensive science of nature, which is rather impossible. The friends

of Mr. *Donati* extol to this day his candour and lively parts. But he had many ungenerous detracting enemies, as appears by rumours intended to ſtain his memory; and importing, that he is ſtill living in Perſia under a foreign dreſs, after having appropriated to himſelf a large ſum of money, deſigned for his literary expedition. This falſe and injurious charge is the more cruel, as it blackens the name of a deſerving man, who, being a martyr to Natural Hiſtory, ſhould rather have been honoured by a ſtatue in a hallowed grove of cypreſs. If its falſhood did not appear in many other circumſtances, it would by the private letters; which he muſt be ſuppoſed to have meant for his own uſe; and would not have ſent them in theſe cheſts had he not been flattered with the unaccompliſhed hope of returning, to unpack them himſelf. But ſo happy a fate was not the doom of this Son of Nature, whom ſhe is ſtill mourning. *Donati* died in Perſia, not by poiſon, as ſpread by another falſe rumour, but by the plague. The friends of ſcience lament his death the more, as not a ſingle paper of his writings and literary collections has been delivered. All the expences and good intentions of a wiſe Monarch, for the improvement of Natural Hiſtory, were loſt at once; and, by the ſame ſtroke, vaniſhed the hopes of many who have been juſtly

afflicted by the similar fate of *Forskol*, *Hasselquist*, and *Loefling*.

Donati could have had no better successor than Dr. *Charles Allione*, the present Professor of Botany at Turin. He is a learned man of the first rank, equally remarkable for his extensive knowledge in the salutary art as for his personal character. His very first acquaintance is captivating, and his conversation inspires friendship and esteem. His practical business as a physician has not hindered him from publishing some excellent writings *; however, it has put him under a necessity of having a substitute, who is Dr. *Giov. Pier Maria Dona*, Professor-extraordinary of Botany, and Inspector of the Academical Collection of Natural History. The Memoirs of the Royal Society at Turin contain some valuable Dissertations of these Gentlemen. The Botanical garden near the palace Valentin belongs to the University, and is under the inspection of Mr. *Allione*. It is well-provided with scarce Alpine plants. Proper care is taken for their growth and preservation. One of the gardeners is every year sent into the neighbouring Alps, to fetch the scarcest Alpine productions.

* C. *Allionii Oryctographia Pedemontana*. Ejusd. *Flora Nicensis*. Ejusd. *Specimen Stirpium Pedemontanarum*. Taurin. 1755. *Flora Pedemontana*, to be published. Ejusd. *Tract. de miliarum origine, progressu, natura, & curatione*. Taurini, 8vo.

Mr.

Mr. *Allione* has himſelf an exquiſite collection of dried plants, inſects, and eſpecially, petrifactions and minerals, chiefly found in Piedmont and Savoy, though foreign correſpondence has equally procured him riches from abroad. The following pieces ſeemed to me remarkably worth notice.

1. Impreſſions and petrifactions of fiſhes in white ſhivery argillaceous limeſtone or marl, ſimilar to thoſe of *Pappenheim*; from *Scappezano* and from *Mondolfo*, in the Roman ſtate; alſo from mount Libanon in Paleſtina.

2. *Nummularii*, round and flat, of a form like the *Cornua Ammonis*; from *Daubrig* in Switzerland, proving that the *Nummularii* are a ſort of ſhells.

3. Petrified wood, worm-eaten by the *Teredo*; from the hills near *Annone nel Contado d'Aſti* in Piedmont.

4. A petrifaction ſimilar to an ear of corn; near *Turin*.

5. Yellow ſulphureous earth, or rather native ſulphur, in grains, mixed with ſome earth from *Tortona* in Piedmont.

6. Native ſulphur in ſmall lumps, from *Tortona*.

7. Foſſil wood, entirely changed into lamellated tranſparent ſelenites, incruſtated with a flint-like ſubſtance; from *La Morra* and *Alice* in Piedmont.

8. Petrified Boletus, from *Morra*; alſo from *Turin*. Undoubted Boleti.

9. Petrified Agaricus, from *Turin*; reſembling an Agaricus.

10. Iron-dendrites on common flint; from England.

11. A porphyry, with white oblong ſpots like the *Serpentino antico*; found in green jaſper at *Monviſo*, a high mountain in Piedmont.

12. Black Iceland agate, a volcanic vitreous ſlag; from *Sardinia*, where it is found in looſe fragments.

13. Iron-coloured fine gloſſy iron-ore; from *Sardinia*.

14. Red and brown-veined jaſper; from Sardinia, on one ſide ſtill unpetrified, tough, red bolus.

15. Some *Terræ Sigillatæ*, of different colours; from the mines in mount *Nailer* near *Hof*, in the Marquiſate of *Baireuth*, for example, from Fuſſ-puhl, where the clay contains red ferrugineous horn-ſtone, and red and green jaſpers.

16. *Speculum metallicum*, or a gloſſy iron ore, on green and red-mixed gabbro; from *Feneſtrella*, a fortreſs in Piedmont.

17. Fine radiate white antimony; from ſome mountains in Piedmont.

18. Cobolt-ore; from Uſſei in Piedmont.

19. Grey antimony; from Sardinia.

20. Cin-

20. Cinnabar; from *Marienberg* in Saxony. Extremely ſcarce.

21. *Sal Gemmæ*; from Sicily.

22. A calcareous breccia, or pudding-ſtone, of an aſh-grey ſubſtance, with roſy-round ſpots or pebbles; from *monte Alcamo* in Sicily, called *breccia roſata*.

23. A ſpecies of porphyry, ſimilar to the black *Serpentino antico*, of a black ſubſtance, with white ſpots; from *Sardinia*.

24. Fine white clay, partly hardened into an opaque milk-coloured, or white ſemi-pellucid flint; ſometimes ornamented with iron-dendrites, which appears in little veins croſſing the white clay; from *Baudiſſé* in Piedmont, in the *Canaveſe*; entirely ſimilar to the white china-clay, and the white flints contained in it; which Mr. *Peithner*, in his Mineralogy, calls Porcellanites, and is found at Kaaden in Bohemia.

25. Small petrified or foſſil ſimple Madrepores, with five points at the under part; from the marl-hills in *Piedmont*. Theſe hills contain many ſcarce, undeſcribed little marine productions. For the greateſt part, they are in Mr. *Allione's* collection, and deſerve to be drawn and deſcribed by him.

26. Malachites in large lumps, ſticking to copper-azure; from *Congo*.

27. Pe-

27. Petrified flint-like wood, in large pieces; common near *Montferrat* in *Piedmont*.

28. Quartz-cryſtals, of a remarkable length; from the *Montagne de Chamonyx* in *Savoy*.

29. *Marmo di Gaſſino*, a grey marble, ſpotted by petrified ſhells; from *Gaſſino* near *Turin*; commonly employed in columns.

30. *Bardilio di Valle di Jeri*, a fine Piedmonteſe marble.

31. *Bardilio di Pæſana*, of a paler colour; from Piedmont.

32. *Alabaſtro fiorito*; from *Buſca* in Piedmont.

33. *Verde di Suſa* is a polzevera; from *Suſa* in Piedmont; white and green, ſimilar to the *Marmo Verde antico*.

I got likewiſe acquainted at Turin with Mr. *Ignazio Somis*, Phyſician of the King, and Profeſſor of Phyſic.

P. Beccaria, a Piariſt, is Profeſſor of Natural Philoſophy, and known abroad by his valuable Treatiſe on Electricity, which appears at preſent in a new edition.

Dr. *Charles Lewis Bellardi*, a phyſician, has in his *Inaugural-Diſſertation*, printed at Turin, 1764, among ſeveral curious phyſical objects, treated *de motu Plantæ ſenſitivæ*. He is a good botaniſt, a diſciple of Dr. *Allione*.

LET-

LETTER XXIV.

Milan, July 8, 1772.

MY journey from Turin hither afforded me ſcarcely any opportunity of making obſervations worth your notice. A plain, flat, well-cultivated country, with ſome ſwampy rice-fields, ſpoke the vicinity of Lombardy. The rice is commonly planted in the Milaneſe, about Mantua; and in the Veroneſe, in the ſame manner as has been deſcribed in *Spolverini's Poema il Riſo*. The Northern part of the Milaneſe, bordering on the Griſon-hills in Switzerland *(gli Grigioni)* is mountainous. Above the *Lago di Como*, in a tract of mountains called *La Grigna*, and in the *Valle Saſina*, are the Milaneſe mines, which incloſed in micaceous ſlate partly yield iron ore ſpeckled with copper, and partly lead-ore. Many conſiderable mountains in theſe parts conſiſt of Granites; ſuch, for example, as thoſe which ſkirt the *Lago Maggiore*, and the delightful Borromean iſlands, in the form of an amphi-

amphitheatre. This Granite is of a faint fleſh-colour, and commonly employed at Milan in columns in churches and cortiles. There are beſides around the *Lago Maggiore*, and other parts of the Milaneſe, different ſorts of beautiful marbles; but they do not take the finer poliſh of ſeveral other Italian ones. I ſhall notice only the following.

A white tigred marble with ſmall black ſpots; from *Lago Maggiore*; beautiful; commonly employed at Milan in the altars and churches.

White *(bianco e bigio)*, from *Lago Maggiore*; ſimilar to the *pietra d'Iſtria*, but coarſer. The cathedral at Milan is built with it.

Black marble; from *Lago di Como*; very beautiful.

There are likewiſe ſome fine calcareous Breccie, which the ſtone-cutters at Milan call *occhiettina*; ſuch as thoſe of the *Lago Maggiore* and *Lago di Como*, called *Breccia vecchia*, &c. But Mr. *Vandelli* will certainly entertain you better on the nature of the Milaneſe mountains, which he has examined on purpoſe, and promiſed to deſcribe, as I told you in one of my former Letters.

The Ambroſian college at Milan poſſeſſes a numerous library, a collection of natural curioſities, ſome antiquities, pictures, and other artificial things. There are ſome valuable and precious pieces; but the whole is rather reſembling a raree-

ſhew

ſhew, than a ſcientifical collection. Among the natural curioſities, I obſerved a great cryſtallization of fine emeralds, in the form of columnar ſherl, with ſmaller polygon and brown ſherl-cryſtals ſticking to a matrix of quartz. Some white opaque and milk-coloured pebble-flints, with incloſed water, deſerved likewiſe to be noticed.

Milan is one of the moſt agreeable places in Italy.

The Prime-Miniſter Count *Firmian* poſſeſſes a choice library and gallery of paintings, and every quality to improve the arts, the ſciences, and the public welfare. His civility to every friend of the ſciences is remarkable.

The Imperial Chamberlain and Privy-Counſellor Mr. *Pietro Verri*, is known by his valuable *Meditazioni ſull' Economia politica*, publiſhed at Leghorn.

P. Paolo Friſi, a Barbanite Profeſſor of the Mathematics, and member of ſeveral learned ſocities, is not only a deep philoſopher, but a learned connoiſſeur in many other ſciences.

P. Ruggiero Giuſeppe Boſcovich, a Jeſuit, and Profeſſor of Aſtronomy at the college, has been long known as a ſagacious aſtronomer and philoſopher. He has made extenſive travels in France, England, Turkey, and Poland; and was recommended to obſerve the tranſit of Venus, when the late

late Engliſh expedition to the South-ſea was reſolved on. He lately publiſhed at Lauſanne, *Journal d'un Voyage de Conſtantinople en Pologne, par le* R. P. Joſ. Boſcowich; and his *Relazione della nuova ſtrada fra Modena e Lucca.* Lucca, 1767. 4to. gives ſome account of the Apennines.

P. La Grange, a French Jeſuit, is at preſent living at Milan, and known as a good natural philoſopher.

Mr. *Paolo Sangiorgio* is a young apothecary, who employs himſelf in botany and the mineral hiſtory of his country. I ſaw in his collection a black vitreous lava or pretended Iceland-agate, whoſe native place he was ignorant of, with little ſtars of concentric large fibres, of a green terreous colour. He ſhewed me likewiſe ſome prints of œconomical graſſes, which his father intends to deſcribe and publiſh.

The Univerſity at *Pavia*, twenty miles diſtant from Milan, is but in it's infancy, though ſupplied with ſome Profeſſors of note.

Abbate *Lazaro Spalanzani*, Profeſſor of Natural Hiſtory, has publiſhed,

1. *Proluſio operis de animalibus Microſcopio viſibilibus.* Mutinæ, 1770, 4to.

2. *Prodromo d'un Opera ſopra la Riproduſſioni animali.* Modena, 1768, 4to.

3. *Memorie ſopra i muli de' vari Autori.* 8vo.

4. *Nuove*

4. *Nuove osservazioni dell' azione del Cuore ne' vasi sanguigni*, 8vo.

5. *De corporibus in aqua resilientibus.*

6. *Tradozzione della contemplazione della natura del Sr. Bonnet, con annotazioni.*

P. Fulgentius Vitman, a Vallombrose Friar, Professor of Botany at Pavia, has published in two volumes, 8vo. *De medicatis herbarum facultatibus.* Faventiæ, 1770.

LET-

LETTER XXV.

Verona, Aug. 1, 1772.

I WENT from Milan by Bergamo and Breſcia to Verona, Vicenza, Padua, and Venice; and am in this place again on my return to Germany. I need not tell you that I unwillingly part from Italy.

As I have entertained you already with the curioſities of ſeveral places in Lombardy, I ſhall be very conciſe in relating my journey from Milan. Do not expect any particular account of the iron-mines in Bergamaſco and Breſciano. I had no leiſure to examine them at the expence perhaps of my life, theſe parts being famous for bloody robberies, ſadly evidenced by a great many ſtone and wooden croſſes in memory of murders committed. Theſe ſkirt the road every where. Peruſe therefore Abbé *Pilati's Saggio d'Iſtoria naturale del Breſciano*, till you come here yourſelf.

Between

Between *Bergamo* and *Breſcia* I obſerved blunted limeſtones, and vaſt quantities of different detached lavas, which prove, that to the north of this country there are tracts of volcanic mountains. Theſe lavas were:

1. Black ſound lava;

2. ——————— with incloſed white garnets;

3. Red lava, with ſmall garnets and ſherl-cryſtals, perfectly reſembling porphyry. Large mountains in the Bergamaſco conſiſt of ſuch lava-rocks, which are dug and cut there into columns and chimney-pieces, ſelling at Bergamo under the name of Sarres. This ſpecies has the hardneſs of porphyry.

4. Red hard lava, ſimilar to the former ſpecies, but containing beſides large white ſherl-parallelopipeds.

Behind *Breſcia* occurred grey limeſtone-hills, which belong to the Alps.

Then I obſerved on the road to *Verona* pieces of,

1. Sound black lava;

2. The ſame with white ſherl-cryſtals.

3. Fragments of columnar baſaltes.

4. Red porphyry-like lava, with white garnet-like ſherls.

5. Grey limeſtone.

Between Verona and Vicenza I ſaw detached,

1. Limeſtone of the Alps. In theſe, as commonly in the calcareous hills, occur now and then ſubterraneous caverns or natural grottos. A remaining part of ſuch a cavern, or rather its upper covering, which reſembles a bridge, is deſcribed in *Deſcrizione d'un meraviglioſo ponte naturale ne' monti Veroneſi.* Verona, 1766, 4to.

2. Black ſound lava; with and without white garnets.

3. Spungy and porous reddiſh grey lava.

4. Black ſound lava; with oblong white ſpots, ſimilar to *Serpentino antico.*

Between *Vicenza* and *Padua,* towards *la Mira,* I ſaw detached lavas and limeſtones.

Abbé *Fortis,* whom I noticed in one of my former Letters, has quitted with the Pope's conſent his regular order, and is at preſent in Dalmatia; where, at the expence of three Venetian noblemen, he makes obſervations on Natural Hiſtory. Mr. *Angelo Donati,* a relation of the celebrated Naturaliſt, and a ſkilful draughtſman, was for ſome time his companion; but he is returned already to Venice.

LET-

LETTER XXVI.

Regenſburgh, Sept. 5, 1772.

I WENT from Verona through Tirol, a country, whoſe old and remarkable mines are better known to you than they might be to a paſſenger who never ſtopped in it. Tirol, though mountainous, is however a fine agreeable and fertile tract of land. The candour and civility of its inhabitants, and the clean and proper accommodation which travellers meet with at inns, recommend it to every ſtranger. As far as *Brixen*, the agriculture reſembled that of Italy, and conſiſted of grapes and maize, figs and mulberries, but no olive-trees. Maize is planted even in the vicinity of Augſbourg.

I ſaw from Verona up to *Chiuſa* a plain flat country. *Chiuſa* is a ſteep limeſtone-hill.

Behind *Volarni* I found calcareous hills; firſt, white ones, whoſe fragments ſkirted the road;

afterwards red ones, with incloſed fragments of *Cornua Ammonis* *; and at laſt grey ones in large horizontal ſtrata, of a ſomewhat ſcaly and ſaline contexture †. Along the road and the concomitant Adige-river, towards Newmark, I obſerved vaſt quantities of looſe ſtones; as,

1. Red porphyry ſpotted with white, ſimilar to the Bergamaſco Sarres, which I conſider as a ſpecies of lava.

2. Black porphyry, with oblong ſpots, ſimilar to the *Serpentino antico*.

3. Grey Granite or Granitello.

4. Between Walſhmichel and Newmark, I ſaw fragments of the porphyry hills beyond Newmark, which I ſhall preſently deſcribe.

To the right beyond this place, there are conſiderable wide-ſtretching porphyry-mountains; conſiſting of, 1. Black Porphyry, with white tranſparent round ſherl-ſpots. 2. Black ſpotted, with red feld-ſpath. 3. Red ſpotted white. The red ſpecies the ſame as the Bergamaſco-ſarres, except

* This is the common red Veroneſe marble, called likewiſe *Breccia roſſa di Verona*. In the ſame tract they have of late diſcovered a fine yellow marble, called *Giallo di Verona*.

† The *monte Baldo*, celebrated for its plants, is of this kind.

that

that the ſpots of feld-ſpath have got by the action of the air an opaque milk-colour; and that thoſe of the porphyry hills, now under conſideration, conſiſt of a fleſh-coloured feld-ſpath, or of a vitreous tranſparent ſherl, ſimilar to that which in the Veſuvian lavas formed garnet-like cryſtals, but here appears in undetermined grains. The black porphyry in theſe hills is ſpotted with the ſame vitreous ſherl, either in oblong or undetermined forms. The ſimilarity of this porphyry with ſome Veſuvian lavas is ſo very great, that even the ſkilfulleſt Mineralogiſt might confound them; and I am convinced that theſe Newmark porphyries are true lavas, though I would not venture any general aſſertion. Another circumſtance, which ſurprized me, countenances this opinion. All theſe porphyry hills conſiſted either of ſeparated or ſtill coherent rhomboïdal columns; or they had, upon the whole, a tendency to ſplit into theſe forms, which is a quality of ſeveral ſorts of baſaltes. Theſe high porphyry hills continued almoſt to *Brandſol*, and were generally cracked and ſplit, moſtly in ſquare columns, with a flat oblique broken top; their form ſo regular, that it cannot be conſidered as accidental, but as that of regular cryſtallized columns. The angles of the oblique fiſſures were commonly oblique, that

is to say, the diameter of the columns was rhomboïdal; however, there are some of a rectangular parallelopiped form; their length different, from a few inches to above three feet Swedish measure; their diameter six inches and more. Many of these columns appeared erected along the road, as the basalt-columns near Bolzena. The darkness of the night hindered me from observing how far these porphyry-hills continued; but I am certain I observed them about one German mile and a quarter along the road between Newmark and Brandsol.

The next morning I found near *Brandsol* slate mountains, partly argillaceous mixed with glimmer, that is to say, gneiss, partly quartzous. In some places I observed sound dark-coloured horn-slate, penetrated with iron. Then succeeded some mountains, which consisted of grey, sound, opaque quartz, sprinkled with small black, or blackish-green sherl-crystallizations. Afterwards gneiss, or horn-slate hills, which continued to *Brixen*. Detached Granite is common near the road.

Beyond *Brixen*, mountains of grey Granite or Granitello appeared, consisting of quartz mixed with mica or glimmer, either in lumps and spots, or in crossing stripes. The feld-spath in it is scarce,

if

if any *. Then ſucceeded micaceous or glimmer-horn-ſlate, in ſome parts ſpotted with feld-ſpath and

* No part of Mineralogy is leſs cultivated than that of the mountain-rocks *(Saxa)*, though it be undoubtedly of great importance in exact and ſcientifical mineralogical obſervations. Every deſcription of a country is attended with great difficulties; and too often we are at a loſs for proper expreſſions, which ariſes from the want of juſt claſſification, knowledge, and denomination of the rocks, which do not generally differ but in the various mixture of their conſtituent parts. Many rocks, either compound or ſerruminated *(Cronſted's Mineral.* § 258.) are ſtill without any name, and ſome others have ſo many and undetermined ones, that they are by no means to be underſtood. For example, Granite, Hornſtone, Hornſtone-rock, Hornberg, Horn-ſlate, Geſtell-ſtein, are undetermined names, and for that reaſon very often confounded and miſapplied. Granite properly conſiſts of Quartz, Feld-ſpath, and Mica, or Glimmer; but ſometimes the ſame name is given to a rock, which contains not a ſingle ſpark of Feld-ſpath. This ſpecies ſhould rather be called Hornberg or Hornſtone-rock. If the Mica or Glimmer-ſtripes in it be very near one to another, ſo as to make it ſhivery or lamellated, it is called Geſtel-ſtein, on account of its being employed in ſupport *(Geſtelle)* of grates and fire-hearths. However, it is common to apply this very name too to the coarſe micaceous Horn-ſtone rock, for want of a better ſpecies applied to the ſame uſe. The names of Horn-ſtone and Horn-ſtone rock are likewiſe given to ſome pebble-flints *(petroſilices)*; nay, Profeſſor *Wallerius* has given them to an indurated clay, which in ſome veins ſkirts the ore *(ſaalband)*. Horn-ſlate is the proper denomination of a rock, conſiſting of

and the before-mentioned grey Granite, which here contained white opaque ſpots of feld-ſpath. Theſe rocks, being but varieties of grey Granite, continued alternating beyond Sterzing.

Beyond *Sterzing* appeared mixed with the former rocks a ſhivery limeſtone, which mixture produced a blueiſh-grey hard limeſtone; then followed a pure, white, and ſhivery limeſtone; again horn-ſlate, and ſo on without any viſible order.

Beyond *Brenner*, a poſt-ſtage in Tyrol, I obſerved ſtraggling, 1. Argillaceous ſlate of a green colour, with calcareous veins. 2. Black and green gabbro, with white calcareous veins, or rather polzevera. 3. Greeniſh quartz, with ſmall red garnets.

Quartz and Glimmer, or Mica, thoroughly and internally blended, ſo as not to be diſtinguiſhed by the eye. Often a good deal of clay is mixed in the ſubſtance of theſe rocks. Till we have better claſſifications and determinations, I have aid down the preceding ones, for the moſt part agreeing with our German and Swediſh Mineralogiſts and Miners. It was merely to be underſtood, and to underſtand myſelf. Conſtantly I have employed theſe names in this ſenſe. They may be inconvenient; and the rocks which they are meant to indicate may be perhaps but varieties on account of the mixture of their conſtituent parts, which I do not queſtion; theſe denominations are, however, neceſſary and uſeful in mineralogical and orological deſcriptions.

Behind

Behind *Inſpruck* occurred low hills of ſtratifie friable and compacter limeſtone; its colour light-grey or blackiſh-grey, with calcareous veins. Gently they aſcended into higher hills of large grey calcareous beds, which between *Naſereit* and *Lermos* formed calcareous Alps, of a remarkable elevation. Cloſe to *Lermos* is a ſteep calcareous Alp, called the Sonnenſpitz, or the Wetterſtein, in which a lead and ſilver-mine, called Silberleuthen, is working.

Beyond Fueſſen towards Augſbourg the country is plain and flat.

Near Augſbourg I ſaw blunted and detached pieces of black porphyry, with white oblong ſpots. The ſame to be found near Munich, and the convent Varenbach, on the Inn. In Bavaria are very commonly found large detached pieces of graſs-green quartz, or rather emerald-matrix *(Cronſted's Mineral.* § 73.) with red tranſparent garnets, which at Munich they miſtake for Granite, and work into fine ſnuff-boxes and other trinkets.

Some hills about Regenſburgh are calcareous; towards Bohemia they conſiſt of Gneiſs and Granite. I ſaw here, near ſome mills on the Danube, quantities of ſquare-cut grey Granite, ſpotted with large parallelopiped of milk-coloured feld-ſpath.

You are acquainted already with Dr. *Sheffer's* works,

works, and with his and ſome other collections of natural curioſities at Regenſburgh.

All along the way from Italy through Tirol to this place, I paſſed over calcareous, then ſchiſtous, and at laſt over Granite-hills; and from the higheſt tract of this country, which conſiſts of Granites, I deſcended in the ſame but reverſed order, over ſchiſtous and at laſt over calcareous hills, in the lower parts of Bavaria. Remember, that the ſame order of rocks and ſtones is obſerved in the higheſt European mountains; ſuch as in the Carpathian hills, the Saxonian ones, the Hartz, in Sileſia, in Switzerland, in the Pyrenees, in Scotland, and in Lapland; and it ſeems to be a fair concluſion, that the higheſt, deepeſt, and moſt ancient mountains, hitherto obſerved, conſiſt of Granite, ſince that rock conſtantly appears in the higheſt tracts of mountains above the other ſuperincumbent and adjacent ones; that the argillaceous Schiſtus or ſlate, whether pure or mixed with quartz and mica, that is, whether a gneiſs or horn-ſlate, is immediately incumbent on, or adjacent to, Granites; and that limeſtone, and other mixed ſtone- and earth-ſtrata, are conſtantly accumulated on this ſlate, or Schiſtus-ground.

This,

This, my dear Friend, concludes my obſervations on the Natural Hiſtory of Italy. You will pardon my involuntary errors. I ſhould be happy in any opportunity to correct the laſt, and to improve the former. This would lead me again into Italy;

Thoſe hallow'd ruins better pleas'd to ſee,
Than all the pomp of modern luxury.

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Lava.
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